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SUSCEPTIBILITIES AND IMMUNITIES.

THE busy round of modern professional and business life allows us but scant time for introspection or for critical examination of our moral and intellectual progress, but the birth of a new year, marking as it does the passing of another milestone of our short journey, gives us pause, and we, most of us, at this season allow ourselves a brief time in which to "take stock."

This same strenuous existence largely prevents us engineers from keeping abreast of the recent developments in sciences other than those cognate to our own, and this is very much to be regretted, as many of us fail to recognise that the fundamental laws governing the physical development of man, govern also his intellectual and moral development.

Recent biological science has shown that each fertilised ovum builds with *mortal* cells a temporary dwelling place (the *body*) round its potentially immortal descendants the *germ cells* which hand on to succeeding generations the all-important *germ plasm* which carries with it the hereditary tendencies. The individual really only receives from his parents the heritage that was theirs, and he starts life, therefore, with a congeries of tendencies which are innate. There are, however, also tendencies which are germinal in character, but which are not inherited or ancestral. These are they which sometimes arise in an individual for the first time in his line or family, they are developed from the germ plasm, and are termed "variations," and are capable of transmission.

All these tendencies or susceptibilities may be awakened into activity by external stimuli in the form of (1) food, (2) use, (3) injury.

Up to the time of birth, the body grows under the stimulus of nourishment, and even afterwards some structures such as hair and teeth grow in this way, but the remainder, although food furnishes the material for growth, grow only under the stimulus of use. Injuries supply the stimulus for the healing growth.

The innate characters are almost exclusively "physical," and it is to the acquired characteristics that we must look for the results of external influences acting on the individual.

We can do little to alter our physical characteristics; the files of the *Pink 'Un* will tell us our limitations in the "records" for running, jumping, swimming, &c., but, fortunately, the same authority cannot set a limit to our mental acquisitions. The quality of brain tissue possessed by the average man is quite sufficient for him to make the mental acquirements necessary for living a great mental life, which is more than we can say for his purely physical characteristics.

Most of our mental qualities are acquired, and, with the possible exception of the desire for sleep when weary, nearly all our instincts are mere incitements to make acquirements.

A man's "soul" is the result of the interaction of his physical and moral surroundings and his innate capacity for development in his struggle against evil of all sorts, and this can, like other capacities, be stimulated or starved.

The highest possibility for man is to possess immunity to all that is detrimental to his physical and to his intellectual and moral life, and susceptibility to all that makes for strength and development.

Susceptibility is the converse of immunity; physical immunity is evolved in races by the elimination of the unfit, and, consequently, the production of immunity to infection or capacity of recovery in the survivors. Acquired immunity may be obtained as the result of recovery from specific disease (*e.g.*, smallpox, measles), or by protective inoculation (*e.g.*, vaccinia, antitoxic sera). The immunity conferred by recovery is lasting in most cases, whereas that by inoculation is temporary, but the process is certain and safe for those conditions in which a serum has been discovered.

Mental immunity to all that retards development, and susceptibility to all that conduces to it, can only be obtained by forming proper habits of mind in thinking, reasoning and inquiring. To live the higher mental life one must be able to concentrate one's attention and to become immune or oblivious to all subsidiary impressions.

Moral immunity may be acquired by suffering—but the immunity conferred by the sowing of wild oats, though it may be lasting, is a dangerous proceeding analogous to the old practice of direct inoculation with smallpox virus—it is all right for those who survive, but the mortality is appalling.

Immunity may, however, be gained by patient effort; the infant mind has only an inborn capacity for acquiring either susceptibility or immunity to mental and moral influences in response to the stimuli of use and environments.

Given an ethical standard—that, for instance, enunciated by Christ—every person has some innate susceptibilities, and some immunities to both good and evil, and these, like natural immunity to some physical condition, can be readily increased or diminished.

The medical faculty are doing all they can to secure that we may become resistant to all adversities that may happen to the body; let us one and all see to it that not only we ourselves, but those with whom we may be brought into contact, may also be resistant to all evil thoughts which may assault and hurt the soul.

THE FAIR WAGES CLAUSE IN GOVERNMENT CONTRACTS.

Nearly 18 years ago, the House of Commons passed a Fair Wages Resolution in the following terms: "That, in the opinion of this House, it is the duty of the Government in all Government contracts to make provision against the evils recently disclosed before the Sweating Committee, to insert such conditions as may prevent the abuse arising from sub-letting, and to make every effort to secure the payment of such wages as are generally accepted as current in each trade for competent workmen"; and effect has been given to this resolution by the insertion in all Government contracts of a Fair Wages Clause, which, although it has been considered satisfactory by the majority of the people concerned, does not go far enough to satisfy the present-day Trade Unionist. As complaints were made of the working of the Fair Wages Clause, a Departmental Committee was appointed in August, 1907, to consider the matter and report whether any administrative changes were desirable to enable the objects of the Resolution to be more effectually attained, especially with a view to the prevention of evasion, the enforcement of the rate current in the district, and greater uniformity of interpretation and working. The Committee, having taken the evidence of a large number of witnesses representing the views of employers and employés, has now published its report; and as the questions considered by it are of great interest to many of our readers, we propose to give a brief *résumé* of the objections made to the present clause and of the Committee's recommendations.

On behalf of the Trade Unions it was stated that difficulties were found in regard to the interpretation to be given to the words "wages current in each trade for competent workmen in the district where the work is carried out," more especially in the case of trades which were not organised, and where the factory in which the work was done was the only one in the district carrying on that particular trade. To meet this objection, it was suggested that the clause should be altered so as to oblige the contractor to pay the Trade Union rate of wages, and where no such rate is in existence, that the rate of the nearest town where there is a Trade Union rate should be enforced. With regard to the latter part of this suggestion, some witnesses put it forward as particularly applicable to cases where the contractor had removed his factory to a more or less rural district; thereby showing a complete disregard of the effect of local conditions, and attempting to establish a uniform rate of wage in town and country, although in the latter place, the cost of living may be less and the manufacturer may have to pay higher rates for coal and raw material.

We are glad to see that the Committee has not adopted these suggestions, but recommends that the present wording of the clause should be retained; evidently holding the view, with which we cordially agree, that local conditions and local customs must be given full weight, and that wages need not be uniform in different districts in order to be fair. To meet the case where there is no accepted "current rate of wages," the Committee recommends that one of the following methods should be adopted, viz. :—

1. That the Government should fix in the contract the rate of wages to be paid to the various classes of workpeople.
2. That a minimum time rate of wages should be fixed below which no person engaged on the contract work should be paid.
3. That the wages should be fixed by a Wages Board.
4. That the contractor should in his tender furnish a schedule of rates of wages and hours of labour to be paid and observed in the execution of the contract.

Of these four alternative suggestions, we think that the first is the one that would meet with most general approval, and offer least chance of dispute; and we do not anticipate any objection on the part of contractors to the Government, when asking for tenders, specifying the rates of wages to be paid in each district, if at the same time an undertaking is given that the contract will not be placed abroad where the scheduled rates cannot be enforced.

Passing, now, to other questions than that of the actual rate of wages, we find that some witnesses asked that "Trade Union Conditions," as well as rates of wages, should be enforced; and that objection was taken to the employment of women, apprentices, and improvers, at lower rates of wages, on work which fully skilled men consider they ought to do, and to the employment of unskilled or less skilled labour on portions of a job, while the men paid higher rates were confined to those portions which involve greater skill. With regard to the observance of Trade Union conditions, the Committee recommends that no words intended to enforce the observance of these conditions should be inserted; but it adds that it considers that such conditions of employment as are generally accepted in the district in the trade concerned must be taken into account, when deciding whether a contractor is observing the fair wages clause or not.

With regard to the employment of women, apprentices, and partly skilled labour, this is an old bone of contention between employers and trade unions; and the employers very naturally object to interference with the management of their shops, and point out that if such interference is allowed, there will be no inducement to cheapen manufacture by the use of automatic or other special machinery, by means of which a comparatively unskilled hand can turn out work as fast and as accurately as the skilled tradesman. When discussing questions of this class, Trade Unionists always appear to overlook the fact that England is a Free Trade country, and that free imports of manufactured articles, when accom-

panied by extreme protection of labour, can only lead to a decrease of home manufactures, and the placing of more orders abroad where the labour charges are not so heavy. We are glad to see that this point has not been overlooked by the Committee, as the report states that there appears to be no good reason for hindering Government contractors in their efforts to improve methods of manufacture, and the Committee, therefore, cannot recommend any alteration of the clause in this respect.

One other point that was raised referred to piecework earnings, and it was contended that a contractor cannot claim to be paying the current rate if this rate is only obtained by persons employed on piecework; and, further, that it is not sufficient for the earnings to be equal to, or greater than, the standard rates for time work, but that the piecework earnings must exceed the latter in a certain proportion assumed to be generally recognised as customary in the trade. The Committee's recommendation on this point is as follows:—"We think that, where persons are employed at piece rates of wages on work for which a current time rate exists, the general principle that the piecework earnings for a given period should exceed the standard time wages for the same period on similar work should be recognised"; and to this we do not think any contractor will object. When, however, it is claimed that piecework earnings should always exceed the time rate by a fixed percentage, the whole utility of piecework is lost, and it becomes practically time work at a higher rate of pay; and as there will always be differences in the speed at which various men can work, the piecework rate will have to be fixed to suit the slowest man, so as to allow him to earn the specified percentage increase over time rates. This is quite contrary to the whole idea of piecework and premium systems, as their object is to encourage men to turn out more work in a given time by offering them an inducement in the form of higher wages in proportion to the extra amount of work done per hour. We know that this view of piecework has always been very distasteful to the Trade Unions, and that in many cases they have done their utmost to prevent the adoption of piecework in their trades; and it would now appear that, finding they cannot prevent the spread of piecework in its various forms, they are endeavouring to rob the system of its value by calling for a fixed uniform piece rate. Regarding the recommendations of the Committee as a whole, we find that whilst they show every desire to protect workpeople against such evils as were disclosed before the Sweating Committee, they do not advocate the adoption of the proposals of the advanced Trade Unions; and we think that they will be accepted generally as satisfactory by all moderate men amongst both employers and employed.

The Working Section of the Patents Act.

Sec. 27 of the new Patents Act, which enables the Comptroller to revoke patents which are worked abroad and not in this country, came into force last August, and has already resulted in the revocation of several patents. Judging from the tone of the Comptroller's decisions, this section is to be administered with the utmost rigour, and apparently only a small percentage of the foreign patentees concerned will be able to give satisfactory reasons why their patents should not be revoked. This will inevitably lead to the establishment in this country of a much greater number of foreign factories than we have already. It will be interesting to note whether in any case the outcome of the new law will be an increase in the cost of patented articles to the British consumer. An ingenious suggestion for evading Sec. 27 is attributed by the *Standard* to Mr. J. N. McCunn, the United States Consul at Glasgow. Mr. McCunn says:—

"I am informed that it would appear to be perfectly in order to manufacture the parts of a machine in the United States, and have them assembled in the United Kingdom. The ground on which this view is taken is that each part of the machine, taken separately, is not a patented article, the patent merely applying to the machine as a whole. No test case has yet been taken in the British Courts, and I am informed that the above is the generally accepted reading of the law, until such a test case is brought."

We do not think our Courts are likely to be influenced by a quibble of this kind, nor to decide that the assembling of parts made abroad is manufacturing in this country to an adequate extent. The greatest latitude appears to have been left by the Act to the Comptroller and the Patents Court to decide what adequate manufacture means. Some opinions on the subject will be found in our Notes to-day.

The Engineer and the People.

In a paper read by Mr. M. Ll. Cooke at the December meeting of the American Society of Mechanical Engineers, a plan for bringing about a larger measure of co-operation between the Society and the general public was formulated. The author emphasised a fact which has of late been urged on this side of the Atlantic also—that the engineering profession receives very little recognition from the lay Press and the public, and its doings are comparatively unknown to the latter. This constitutes a serious loss to both parties, and a remedy is urgently needed. Very much could be done by the great engineering societies if they would but arouse themselves and adopt an enterprising attitude, instead of proceeding on the humdrum and almost furtive lines hitherto pursued. The leading engineering institution of the world—the Civil Engineers—for instance, jealously withholds its papers and proceedings from publication in the Press.

The author points out that the newspapers would gladly publish engineering reports on matters of public interest if they were provided with suitable abstracts of varied lengths, in proper shape for the printer. The preparation of these abstracts should be undertaken by the Societies, and, we may add, they should not consist of mere subject headings, nor should they attempt to touch upon every matter dealt with in the papers and discussions; they should be written from the view-point of the newspaper editor, seizing the features of general interest, and dishing them up in a form adapted to the popular palate.

Mr. Cooke urges that the Societies should take the public into their confidence and let it see what they are doing. The far older and even more conservative profession of medicine has abandoned the attitude of professional reserve and hidden mystery, and has for years carried on a campaign in the columns of the lay Press against disease and bad sanitation; why not follow this wise example? Hole and corner methods are out of date. The engineering societies have public duties to perform, to which they are not awake; they are agitating for that public recognition of their services to which they are entitled—let them also fulfil their duties to the public and educate the latter, so that it can appreciate the value and meaning of the engineering profession.

The "Pay-as-you-Enter" Car.

Two short papers touching the construction and operation of this modification of the existing form of car used in America were read before the Street Railway Association of New York State, and reported in the *Electric Railway Journal* of July 4th. An idea is abroad that the P-A-Y-E. car, as it is called for short, is single-ended, as the first car of the type was used in Montreal, and that happened to be a single-ender. The system is, of course, equally applicable to the car having two driving platforms. Some alteration in the structure is necessary to adapt a car to the P-A-Y-E system, and the platforms have been made longer in order to accommodate 20 passengers or so while they are waiting to get to the fare box and pass to the inside.

In 1907 the Chicago Railway Co. put 300 P-A-Y-E cars on the streets, and are adding to the number. In Buffalo a start was made with 50 cars, and 100 more are being changed. New York and New Jersey also have begun each with over 100 cars, and they are obtaining great satisfaction from them.

D

The chief advantages claimed for the P-A-Y-E car are :—

1. Fewer fares are missed. Temptation is taken off the conductor, who has more time to devote to the safety of his passengers, to the issue of transfers, and to the close checking of fares deposited.

2. The average speed of the car is increased, as passengers can enter at one end while others are alighting from the driver's end.

3. The last advantage may be so great as to lead to a reduction in the number of cars in use.

4. The number of personal accidents is diminished, due to the presence of the conductor on the rear platform at all times, while the driver brings the car to a full stop before allowing anybody to leave the car at his end, and is able to see when the last passenger is clear of the step.

5. The passengers of a crowded car are not inconvenienced further by a conductor elbowing through them to collect fares.

Intending passengers are supposed to have their fares ready before boarding a car, and as they pass in they slip the money into the fare-box, which consists of a receptacle on top with a tripping device, by which the money is deposited into an inner cash-box, where it stays until it is taken to the office.

On account of the great difference between the fare systems of the two countries, it is not likely that the P-A-Y-E car will be taken up very readily in England, but it is an idea well worth consideration, and within the last few days a manager of one of our tramway systems has reported to his committee that he is considering the design of one of these cars for use on his lines.

London United Tramways.

To the 5 per cent. cumulative preference shareholders in the undertaking of the London United Tramways, Ltd., the announcement conveyed in the recent circular issued by the directors of that company, will not prove pleasant reading. If the intimation that for the second half of 1908 their dividend *pro tem.* will be only at the rate of 2½ per cent., instead of 5 per cent., per annum, thus making to date for the year 3¾ per cent., be unwelcome news to them; it is also extremely unsatisfactory to the ordinary shareholders. The board, with some apparent caution, proceed to state that the revenue account will show, doubtless, a balance sufficient to cover the full dividend on the preference shares for the year. If it does, will they distribute it so that there will be no reality in the present prospective 1¼ per cent. liability contingent upon profits, or will they swell their depreciation and renewals credit balances with it, subject to "carry forward," if there be anything to carry? We are further informed that in view of the necessity for providing funds to meet future renewals, the strengthening of the reserve funds should be no longer delayed, and that for the present the payments on account of preference dividend should be limited to 2½ per cent. per annum. In this sentence there appears to be an unfortunate confusion in the use of terms.

Suffice it to state, that a renewals account is not a reserve fund. The question of depreciation and renewals is ever with us, and though the step proposed has been too long delayed, we are glad even at the expense of dividends that the directors have resolved upon the course of strengthening their hardly more than nominal and comparatively ineffective renewal accounts, the wisdom of, and the necessity for, which must be evident to the shareholders of the company.

In our issue of April 3rd of last year we wrote, "Contingencies and renewal funds are out of all proportion to the size of the undertaking, with its 55 miles of tramways and its capital expenditure of £3,900,000. Means should be devised, even at the expense of dividends, to bring them up to figures which can be deemed reasonably satisfactory." We are afraid that the "means devised" have been the result of "Hobson's choice," which too often irresistibly forces itself upon our attention.

VOLTAGE LOSS IN ALTERNATING-CURRENT OVERHEAD LINES.

BY J. A. MORTON.

MOST engineers are familiar with the Mershon chart for finding voltage losses in alternating circuits. Last year Messrs. C. F. Scott and C. P. Fowler in an article in the American *Electrical Journal* described a simpler and quicker method of doing this.

This method is here re-described in terms of British conditions and practice, in the hope that it will be found useful to British distributing engineers.

It is assumed that the following details are known :—E.M.F. at point of use, KW. to be delivered, power factor of load, size of wire, distance between wires, periodicity, and length of route.

In a direct-current circuit the drop in voltage depends upon the current and the ohmic resistance. In an alternating-current circuit the total drop depends not only upon the current and the ohmic resistance, but also upon the self-induction of the circuit and the power factor of the load. The effects of electrostatic capacity may usually be ignored in the case of overhead lines, and no account is here taken of capacity.

It must, however, be clear that in very long overhead lines the capacity current may be so large as to make the resultant current in the line a different value to the line current itself, on which latter these losses are usually based. This is seen from the vector diagrams given in figs. 1 and 2.

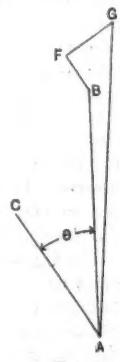


FIG. 1.

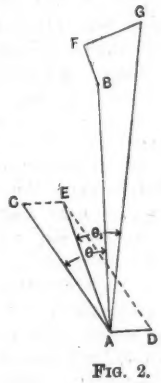


FIG. 2.

In fig. 1 the capacity current is ignored. A B is the E.M.F. at point of use, A C the full load current lagging behind A B by angle θ, corresponding to the power factor of the load ($\cos\theta$ = power factor of load).

Then in fig. 1, B F is drawn (to same scale as A B) representing the resistance drop; this vector is parallel to A C, the current in line, and is calculated on this line current; vector F G is drawn at right angles to B F, representing the E.M.F. of self-induction, and is also calculated on current A C. Then A G represents the impressed volts, and the difference between A B and A G is the lost volts.

In fig. 2, where the capacity current is taken into account, this capacity current is represented by A D drawn at right angles to the voltage line A B, *i.e.*, 90° in advance, and to the same scale as line current A C. Therefore, the total resultant current in the line is not A C as in fig. A, but A E. It is on this current that the resistance drop B F, and self-induction volts F G should be really calculated, and not on A C. Then, again, B F will be parallel to A E instead of A C, so that the difference between A G and A B in fig. 2 is the real voltage loss, and the kilowatts delivered to line are A G volts × A E amperes × $\cos\theta_1 \div 1{,}000$. It can be easily seen that the capacity current may have an effect on the voltage loss and the overall efficiency of the line.

It must be understood that the diagrams are not to scale, and the capacity current value is exaggerated merely to make the diagrams plain. In practice, the capacity current is nearly always small in comparison to the line current (when the line is working at anything like full load), and for most

practical purposes this capacity current may be, and is, ignored in these present calculations.

A practical and ready method of finding the drop under given conditions is here described, in which the drop or "resistance volts" which would result were a direct current to flow through the circuit is first determined, and then a "drop factor" is found by which the drop with direct current must be multiplied in order to obtain the drop produced by alternating current. The drop factor depends upon three considerations—(1) the ratio between the ohmic value of self-induction (reactance) and the ohmic resistance; (2) the power factor of the load; and (3) the percentage value of the resistance volts.

power-factor over a single-phase line 2,000 yards long, composed of two No. 1 S.W.G. copper wires, the periodicity being 60, and the conductors being spaced 12 in. apart.

The first step is the determination of the apparent KW., which is obtained by dividing the delivered KW. by the power factor, or 50 ÷ ·95 = 52·6 apparent KW., which results in a single-phase current of 52,600 (watts) ÷ 1,000 (volts) = 52·6 amperes. In Table I the resistance per 1,000 yards of line for No. 1 wire is ·694 ohm, hence the lost resistance volts = 2 × 52·6 × ·694 = 73 volts. This figure represents the ohmic loss in volts.

Referring again to Table I, it will be seen that the ratio of reactance to resistance for No. 1 S.W.G. wire with 12-in.

TABLE I.—Ohmic Resistance and Ratios of Reactance to Resistance.

Size of copper line wires, S.W.G.	Area of copper line wires, sq. in.	Resistance at 60° F., in ohms.		Ratio of reactance to resistance for various distances between wires and various periodicities.																									
				12 in.				18 in.				24 in.				30 in.				36 in.				42 in.				60 in.			
		Per mile of line.	Per 1000 yd. of line.	Cycles per sec.				Cycles per sec.				Cycles per sec.				Cycles per sec.				Cycles per sec.				Cycles per sec.				Cycles per sec.			
				25	40	50	60	25	40	50	60	25	40	50	60	25	40	50	60	25	40	50	60	25	40	50	60	25	40	50	60
4/0	·1257	·687	·390	·64	1·02	1·28	1·53	·70	1·12	1·40	1·68	·74	1·19	1·48	1·78	·78	1·24	1·55	1·86	·80	1·28	1·60	1·92	·82	1·32	1·65	1·98	·88	1·40	1·76	2·10
3/0	·1087	·794	·451	·56	·89	1·12	1·34	·62	·99	1·23	1·48	·65	1·05	1·31	1·57	·69	1·10	1·37	1·65	·70	1·12	1·40	1·69	·72	1·15	1·43	1·72	·76	1·22	1·53	1·83
2/0	·0951	·908	·516	·50	·80	1·00	1·20	·55	·87	1·09	1·31	·58	·92	1·16	1·39	·61	·96	1·22	1·46	·62	·99	1·24	1·49	·64	1·02	1·27	1·53	·68	1·08	1·36	1·63
1/0	·0848	1·047	·595	·44	·70	·88	1·06	·48	·76	·95	1·14	·51	·81	1·01	1·22	·53	·85	1·06	1·27	·55	·87	1·09	1·31	·56	·90	1·12	1·35	·60	·95	1·19	1·43
1	·0707	1·222	·694	·37	·61	·77	·92	·42	·66	·83	1·00	·44	·70	·88	1·05	·46	·74	·92	1·10	·48	·76	·95	1·14	·49	·78	·97	1·16	·52	·82	1·03	1·24
2	·0598	1·443	·819	·33	·53	·66	·79	·36	·57	·72	·86	·38	·60	·75	·90	·39	·63	·79	·94	·41	·65	·82	·98	·42	·67	·84	1·00	·44	·71	·88	1·06
3	·0499	1·731	·983	·28	·45	·56	·67	·30	·49	·61	·73	·32	·51	·64	·77	·33	·53	·67	·80	·35	·55	·69	·83	·36	·57	·71	·85	·38	·60	·75	·90
4	·0423	2·042	1·160	·24	·39	·49	·58	·26	·42	·53	·63	·27	·44	·55	·66	·29	·46	·57	·69	·3	·47	·59	·71	·31	·49	·61	·73	·3	·51	·6	·77
5	·0353	2·446	1·390	·21	·33	·41	·49	·22	·36	·45	·54	·23	·37	·47	·56	·24	·39	·49	·59	·25	·40	·50	·61	·26	·41	·52	·62	·27	·43	·54	·65
6	·0289	2·982	1·694	·17	·27	·34	·41	·19	·30	·37	·45	·20	·31	·39	·47	·20	·33	·41	·49	·21	·34	·42	·50	·22	·34	·43	·52	·23	·36	·45	·55
7	·0243	3·548	2·016	·15	·24	·30	·36	·16	·26	·32	·39	·17	·27	·34	·41	·18	·28	·35	·42	·18	·29	·36	·43	·19	·30	·37	·45	·20	·31	·39	·47
8	·0201	4·292	2·438	·13	·20	·2	·30	·14	·22	·27	·33	·14	·23	·29	·34	·15	·24	·30	·36	·15	·24	·31	·37	·16	·25	·31	·38	·17	·26	·33	·40
9	·0163	5·300	3·011	·11	·17	·21	·29	·11	·18	·23	·27	·12	·19	·24	·28	·12	·20	·24	·29	·13	·20	·25	·30	·13	·21	·26	·31	·14	·22	·27	·33
10	·0128	6·709	3·812	·08	·13	·17	·20	·09	·14	·18	·21	·09	·15	·19	·22	·10	·15	·19	·23	·10	·16	·20	·24	·10	·16	·20	·24	·11	·17	·21	·26

Notes.—(*a*) The resistance is given per mile and per 1,000 yd. *of line, i.e.*, the actual length of *wire* is two miles and 2,000 yd. respectively.

(*b*) The resistances given are for hard-drawn wire.

(*c*) In three-phase circuits the conductors are supposed to be spaced at the corners of an equilateral triangle with distances between centres as given above.

(*d*) The ohmic value of self-induction (reactance) per mile or per 1,000 yd. of two-wire circuit = resistance × ratio. The self-induction in millihenries per mile or per 1,000 yd. of two-wire circuit—

$$= \frac{\text{Resistance} \times \text{ratio} \times 1{,}000}{2\pi \times \text{cycles per second}}.$$

The first of these things depends upon the size of wire, the distance between wires and the frequency. Table I gives the ratio of reactance to resistance for conditions which are most likely to occur in English practice.

This table has been calculated from the simplified Maxwell formula for induction, viz. :—

$$\text{Millihenries per mile of single wire} = ·08046 + ·741 \log\left(\frac{d}{r}\right),$$

where d = distance between centres of wires in inches, r = radius of wire in inches.

The ohmic value of self-induction (*i.e.*, the reactance) per mile of circuit (*i.e.*, two wires) is—

$$\text{Henries} \times 2\pi \times \text{periods} \times 2,$$

and the ratio of this reactance value to ohmic resistance for various sizes of wires, &c., is given in this Table I. From this table can also be obtained the ohmic value of self-induction, or the self-induction for various sizes and spacings of wires (see note (*d*) to table).

The effect of the power factor of the load is given in Table II, in which the drop-factors for various ratios of reactance to resistance and various power-factors are given. These have been determined from Mr. Mershon's chart by assuming a resistance loss in volts equal to 10 per cent. of the delivered volts.

The third consideration, the percentage value of the resistance volts, has a relatively small effect on the value of the drop-factor, as can be seen from the vector diagrams above, so that the values given, which are determined for a resistance loss of 10 per cent., may be accepted as practically correct for all resistance values not exceeding 15 or 20 per cent. The greatest discrepancy occurs when the ratio is high and the power-factor is 1·0.

To illustrate the use of thsee two tables, two examples are here worked out.

Example 1.—Single-Phase.

It is desired to deliver 50 KW. at 1,000 volts and ·95

TABLE II.—Drop-Factors when Lost Resistance Volts are 10 per cent. of the Delivered Volts.

Ratio of reactance to resistance.	Drop-factors for power-factors of						
	1·0	·95	·90	·85	·80	·70	·60
0·1	1·00	1·00	1·00	0·94	0·88	0·80	0·70
0·2	1·00	1·01	1·01	0·98	0·92	0·86	0·82
0·3	1·00	1·03	1·05	1·02	0·99	0·93	0·89
0·4	1·00	1·08	1·10	1·08	1·04	1·00	0·93
0·5	1·00	1·11	1·14	1·13	1·10	1·07	1·01
0·6	1·01	1·15	1·18	1·19	1·15	1·14	1·09
0·7	1·02	1·18	1·23	1·24	1·21	1·20	1·17
0·8	1·02	1·21	1·28	1·29	1·29	1·27	1·24
0·9	1·03	1·25	1·33	1·34	1·34	1·35	1·32
1·0	1·04	1·28	1·37	1·39	1·40	1·41	1·39
1·1	1·05	1·32	1·41	1·44	1·45	1·48	1·47
1·2	1·06	1·35	1·46	1·50	1·51	1·55	1·54
1·3	1·07	1·39	1·51	1·55	1·57	1·62	1·63
1·4	1·08	1·43	1·55	1·61	1·64	1·70	1·71
1·5	1·10	1·47	1·60	1·67	1·70	1·77	1·80
1·6	1·11	1·51	1·65	1·74	1·77	1·85	1·87
1·7	1·13	1·55	1·70	1·79	1·84	1·92	1·95
1·8	1·15	1·59	1·76	1·85	1·91	1·99	2·04
1·9	1·17	1·63	1·82	1·91	1·98	2·06	2·11
2·0	1·18	1·68	1·87	1·96	2·04	2·14	2·19
2·1	1·20	1·72	1·92	2·03	2·10	2·21	2·28
2·2	1·22	1·77	1·98	2·09	2·17	2·29	2·37

spacing at 60 periods is ·92. In Table II this ratio comes between ·9 and 1·0, and the corresponding drop factor for ·95 power factor is about 1·26. So that the total drop in volts is 73 (ohmic volts) × 1·26 = 92 volts, or expressed as a percentage of the delivered volts = 9·2 per cent. The impressed voltage will therefore be 1,000 + 92 = 1,092 volts.

Example 2.—Three-Phase.

It is required to deliver 1,500 KW. at 20,000 volts three-phase with ·6 power factor over a 25-mile line composed of

three No. 0 S.W.G. copper wires, 36 in. apart, with periodicity of 25.

The real KW. being 1,500 and the power factor ·6, the apparent KW. = 1,500 ÷ ·6 = 2,500 apparent KW. As the circuit is three-phase, the apparent KW. to be considered in this example are one-half of the total apparent KW., or 2,500 ÷ 2 = 1,250 KW., which gives a current of 1,250,000 ÷ 20,000 = 62·5 amperes. This is the current in an equivalent single-phase circuit delivering half the output with the same per cent. loss and drop as occur in the three-phase circuit.

From Table I, the resistance per mile of line for No. 0 S.W.G. copper wire is 1·047, hence the lost resistance volts = 25 × 62·5 × 1·047 = 1,636 ohmic volts.

In Table I, the ratio of the reactance to the resistance for No. 0 wire with 36-in. spacing at 25 cycles = ·55. In Table II, the ratio ·55 is midway between ·5 and ·6 and the drop factor corresponding to this for ·6 power factor is midway between 1·01 and 1·09, say 1·05. Hence, the total drop = 1,636 × 1·05 = 1,718 volts, or expressed as a percentage of the delivered voltage = 8·6 per cent. The impressed voltage would be 20,000 + 1,718 = 21,718 volts.

NOTES.—(*a*) Should the temperature of the wire be over 60° F. due to the atmosphere or to a high current density, then the increased ohmic resistance must be taken into account. Suppose, for instance, that in example I the temperature was 80° F. instead of 60° F., then the ohmic resistance is increased about 5 per cent. above normal. Then the resistance per 1,000 yards is ·694 + 5 per cent. = ·729. This means that the ratio with 12-in. spacing at 60 cycles is not ·92 but $\frac{·92 \times ·694}{·729} = ·88$. Therefore, in this case the ohmic loss = 2 × 52·6 × ·729 = 76·7 volts.

In Table II, the drop factor for this ratio at ·95 power factor is 1·24, so that the total drop in this case is 76·7 × 1·24 = 95 volts. The difference in this instance is small and hardly worth taking into account. If the line were carrying heavy currents which raised the temperature, say 100° F., then the effect on drop would be much greater.

(*b*) In two-phase four-wire problems, take half the total kilowatts delivered, and work out as single-phase.

(*c*) If the problem is to find the size of wire for a given drop, it must be solved by trial: *i.e.*, assume a size of wire which gives about the right drop under continuous current, and calculate the drop from the tables in the manner indicated; the result will show approximately the direction and extent of change necessary in the size of wire to give the required drop.

SOME REFLECTIONS ON LAMPS.

[COMMUNICATED.]

"MAKE certain that your existing consumers are satisfied, and your progress will not be delayed."

When one is endeavouring to obtain new business, the work goes ahead right merrily provided the above maxim has been complied with. In many cases one meets with a check otherwise, the prospective consumer remarking that he has just seen someone who told him that he would be foolish to go in for the light. If that remark is ever made to our B.D. man, by hook or by crook, by blarney or otherwise, he gets to know the name of the informant, and by seeing that he has the maximum amount of light at the minimum cost, takes good care that no repetition of bad advice will be given.

In the interregnum between one winter and the proved success of the tantalum lamp, the B.D. were rather at a loss to know what to bring before consumers. Their carbon-filament lamps were as good as they could be persuaded to adopt, a number having been tested, and a large percentage consigned to the scrap heap in the early autumn. Heating was scarcely worth worrying about, on account of tariff, and in order to have something ready up their sleeve, the B.D. went in for illumination testing. The usual consumer's satisfaction may be said to vary directly in proportion to the amount of trouble taken over him and inversely as the cost of such trouble.

Bearing this in mind, it was obvious that the most desirable step was to increase effective illumination with a low-priced reflector. Several reflectors were, therefore, tested, and the contractors given advice as to the most suitable reflectors for certain purposes. A number of reflectors were sold in the town, and the effective light in the shop windows increased considerably without an increase in the electricity bill.

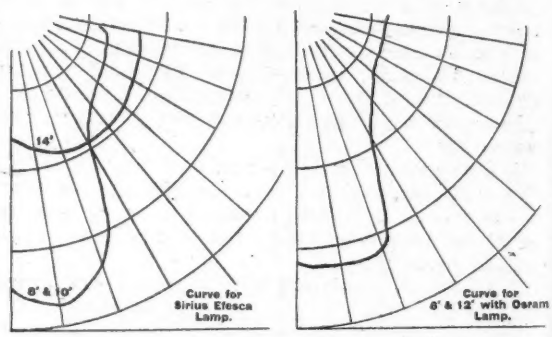
With the carbon-filament lamps, the illumination curve was very satisfactory with many reflectors, especially the silvered shallow and dome type; a concentration of as much as five times the M.H.C.P. being obtainable in certain directions, with a very effective distribution for shop window lighting. The tantalum lamp then made its appearance, and several consumers, after the first burst of enthusiasm, albeit veiled with suspicion, began to think the increase of illumination was not so good after all—naturally, too, since the multiplier of the M.H.C.P. dropped to $2\frac{3}{4}$, instead of 5, obtained with the carbon lamp.

The next change of lamps, however, made matters worse, for as well as looking very ungainly, the Osram type of lamp only gave $1\frac{3}{4}$ with the same reflector. The three effects are given below:—

Lamp.	*Deg. from Vertical.* 0	30	*Remarks.*
Carbon	5	3	Good curve for 30° lighting
Tantalum	$2\frac{3}{4}$	$1\frac{3}{4}$	Best for 20° limit.
Osram	$1\frac{3}{4}$	1	Poor curve.

Since the extra cost and the fragile nature of the Osram filament rather overbalanced the saving in increased efficiency at the time the lamps were put on the market, nothing much was done about the poor curve. Since then, however, with reduced prices and the increasing use of the tungsten filament lamps the question of efficient reflectors has become well worth considering.

To start with, we worked on the idea of using the old type of silvered reflector, but of increasing the value of the curve by varying the position with regard to the filament.



LIGHT DISTRIBUTION CURVES, WITH SPECIAL REFLECTORS.

If, however, the curve improved in one direction, a falling off was found in another direction, and the results were practically useless.

To find a cheap satisfactory type of reflector, various catalogues were searched through, and with the exception of a cheap metal reflector for the Sun tantalum lamp, which proved very useful in giving an even 40° distribution with an average multiplier of $1\frac{1}{2}$, nothing suitable could be found.

Possibly there are several reflectors on the market of the most desirable design, but if so the makers and retailers seem very shy of pushing them. Certainly there are several ornamental *shades* of very nice design on the market, but light absorption is not what our B.D. were after. They agree as far as "Do not put your light under a bushel," but they add the corollary, "unless the bushel gives a good distribution curve."

Experiments have lately been made with the same type of silvered shade but in combination with an extension, which can be made ornamental if desired. Cardboard fittings as used over billiard tables were placed over the silvered shade, and tests taken with the edges projecting various lengths, the angle of the cardboard being kept constant.

The Sirius-Efesca and Osram lamp were used for the tests, and very satisfactory results were obtained, especially

in the former case. The man who put the middle support in the S.-E. lamp and designed the filament in the inverted cone-shape was on the right track for good effect.

The figures given below, to avoid controversy, are not candle-powers, but are all comparative (few people will admit that others can measure candle-power, apparently) :—

Degrees from vertical.	Sirius-Efesca lamp reflector.					
	10"	12"	14"	8" & 10".	8" & 12".	8" & 14".
0	1·16	1·6	1·6	3·49	3·13	3·13
10	1·33	1·6	1·77	3·69	3·04	2·56
20	1·37	1·67	1·85	3·30	1·95	1·72
30	1·4	1·67	1·85	1·76	1·22	1·51
40	1·52	1·67	1·85	1·43	1·16	1·33
50	1·52	1·67	1·77	1·32	1·20	1·26
60	1·63	1·67	1·67	1·19	1·16	1·26
70	1·47	1·6	1·67	1·19	1·05	1·22
80	1·47	1·6	1·57	1·09	1·07	1·2

The reflector references are 10 in., 12 in. and 14 in. cardboard, and the same in combination with an 8-in. silver shallow reflector.

Degrees from vertical.	Osram lamp reflector.			
	12"	14"	8" and 12"	8" and 14"
0	1·02	1·11	3·18	2·87
10	1·02	1·28	3·02	1·93
20	1·12	1·19	3·18	1·69
30	1·12	1·12	1·69	1·39
40	1·22	1·28	1·41	1·3
50	1·28	1·3	1·19	1·19
60	1·19	1·3	1·14	1·18
70	1·19	1·3	1·12	1·11
80	1·18	1·19	1·12	1·11

The best of these results, namely, the 14 in. and the 8 and 10 in. combined for the S.-E. lamp, and the 8 in. and 12 in. for the Osram lamp are given in the curves.

This question of illumination is now being recognised as a very important item, and it seems a pity that some central body cannot undertake the testing of reflectors for different lamps. The general requirements are a good diffusion curve similar to that shown for the Sirius-Efesca lamp and single reflector, and a good concentration for 30° on either side of the vertical.

If supply stations could be certain of obtaining reliable data of the best combinations for the different types of lamp on the market, it is nearly certain that supply engineers would be willing to subscribe a sum to cover the expense of such an institution.

Undertaking lamp testing is, to a certain extent, asking for trouble, although the improved light and satisfaction of consumers is a good return for that trouble, whilst from the lamp makers' point of view, the extra demand for new lamps should, to some degree, compensate them for the inconvenience caused. When, however, one turns to reflector testing, one finds that the time necessary is a serious consideration if the ordinary photometer is used, and it is for this reason that a central institution could justify its existence.

Our B.D. have certainly got a scheme on the tapis at present which may mean a considerable time saving and the elimination of the personal error, but as yet it is not "on the market."

Electric Lighting Provisional Orders. — In our issue of December 4th, 1908 (p. 960) there appeared a list of applications for provisional orders. We have now received an official list of such electric lighting applications from the Board of Trade, and on comparison we find that the following should be added to our former particulars:—

Chipping Norton and District Electric Light and Power Co., Ltd., for the Borough of Chipping Norton.

Dunfermline and District Electric Lighting (Amendment) Order, for the Corporation.

Skelmorlie and Wemyss Bay Gas and Electric Supply Co., Ltd. Order for portions of the parishes of Inverkip and Largs.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

London County Council Turbines.

After perusal of the letters of both Mr. G. Wüthrich, the London representative of the Maschinenfabrik Oerlikon, and Mr. Horace Boot, consulting engineer, Electricity Works, Tunbridge Wells, in your valuable paper, I feel that I should also like to add my opinions on the above subject.

Whilst entirely agreeing with Mr. Boot's views, I further hope that his letter will serve its purpose, and that in future the Corporations of our many large towns will not be so eager to have foreign productions on their premises, and will only accept tenders from, and place orders with, British firms.

On the one hand, these Corporations hold special meetings to consider the "Unemployed Question," solicit help and devise all kinds of schemes in order to obtain small donations to help the many thousands in such a position ; they, on the other hand, rob the British working man of his means of support, *i.e.*, work, by giving it to other firms on the Continent, in other words, paying foreigners to do their work. It may also be noted that the donations collected are small, but the sums paid to foreign firms amount to thousands of pounds annually. I, personally, would not buy anything abroad that I could obtain in England.

The workmanship and quality of British-made goods have yet to be beaten, and I firmly believe that we are still "the" first. It is, moreover, strange that the English people give so very many of their large and important orders to the foreigners at all, to the Germans in particular. Their persistent hatred for us and everything English is so intense that boycotting their country and its manufactures would, no doubt, be very beneficial, and do them a world of good. Surely the Continent of Europe offers them enough scope for the disposal of their goods—electrical manufactures and otherwise—without their having to export them to England, that country especially which is always the object of their hilarity and derision. They do not require us, nor wish for our friendship, only our good money.

I may mention that I have been with the British Westinghouse E.L. and Manufacturing Co., Manchester, for two years, and am intimately acquainted with the class of work and kind of goods they turn out. I speak, however, let it be noted, from a quite unbiased point of view, and have no interests in the firm. I have no doubt but that the firm in question will turn out a turbo-generator set for the Greenwich central station which will do them credit, and will quite come up to the expectations of the L.C.C.

In conclusion, I may say that I am, to my greatest regret, at present earning my livelihood on the Continent, hence my writing from Germany.

Concilio et Labore.

Germany, *January 2nd*, 1909.

Cheap House Wiring.

"T. J's." letter in your current issue is rather incoherent, but is probably not intended to be clear. What—for example—is the meaning of the sentence "Mecca of all gas fitters, . . . &c. ?" Mecca was (and may still be) a pleasant place to the pilgrims and others who journey to it.

Is it a joke to speak—in effect—of a house lighted by gas when the gas is burnt in an engine ?

"T. J." has ignored the question of first cost, and his argument—such as it is—amounts to this :—One has no right to grumble at gas light when one might pay for a small gas-electric installation ! ! I reviled a man who preferred £10 to the electric light from public mains, and "T. J." grumbles at me apparently because I did not spend—shall we say—five or six times that amount in order to get electric light in a very much less convenient manner.

"T. J." also ignores the question of running costs, for I take it his toy gas-engine does not start, and stop and oil itself, and keeps itself clean ; and the toy dynamo presumably requires some attention. Do the lamps run steadily, or is there an accumulator ? And what about repairs, interest

and depreciation? Also, has "T. J." any neighbours, and if so—what do they think of the gas-engine? "T. J." reminds me of the lady who spends any amount of time and trouble on some piece of needlework, and is quite satisfied if—counting the cost of materials alone—she is, say, eighteenpence to the good as compared with the shop price of the same article.

Finally, it is not logical to presume a man's ignorance of something, and then denounce him for it.

W. Perren Maycock.

London, S.E., *January 1st*, 1909.

Silence is Golden.

I have always understood that the object of an engineer in writing to the technical Press, is either to give or elicit information useful to himself and his professional brethren. So far as I can see, Mr. Abraham's letter does not do this, nor is the subject matter of his letter of interest to anyone beyond the parties concerned. Under the circumstances, I think it would have been better, had it been necessary to refer to the matter at all, for Mr. Abraham to have enlightened the gentleman (who, by the way, may be holding a position which Mr. Abraham considers he himself should now be holding) privately, thus saving the time of your good self, your printers, and, last but not least, your readers.

In future, therefore, let Mr. Abraham adhere to the motto with which he concludes his letter.

Another Ignoramus (possibly).

Some time ago at a large alternating-current supply station in the Midlands a vacancy occurred for a "shift engineer" with good technical knowledge.

After several likely men to fill the post had been interviewed, eventually one was practically decided upon, who said he had had 20 years' theoretical and practical training. He was, of course, shown round the works, and was most interested in all that he had seen, until he got to the switch gallery; here, on being asked to go behind the switchboard, at the same time scrambling through various cables, &c., he surprised the chief engineer by asking the following question: *Which is the positive bus-bar?*

He eventually lost the situation.

E. G.

Cannot something be done to make the loquacious individual hailing from Cambuslang adopt the motto he so *eloquently* advocates?

Nous Verrons.

Which is the Rational Method of Stoking?

Would it not be more satisfactory to anyone requiring real information to make some inquiries at Burnley in preference to accepting the admittedly interested statements of one party, or the thinly veiled though evidently somewhat similar interest of "Radix," who appears to have had some purpose in mentioning this particular town? I have seen the Burnley plant, and will keep the results of my investigato myself rather than incur the wrath of any of the stoker-makers concerned therein. One is inclined to stand in awe of these gentlemen, as, judging from the records of the Law Courts, and the correspondence and advertisements emanating from the various firms, pugnacity is one of the concomitants of stoker-making. Your correspondent "Engineer," appears to have had a lengthy and unfortunate experience of stokers, but I cannot discover in his letter any argument against the *principle* of the over-feed method, his remarks being confined to the faults of the *machines* he has come across which have been devised for the purpose of firing by that method, and he undoubtedly "touches the spot" when he remarks that "where the stokers have been working about three or four years" (he might have said one year and not be far out) "they have been very little better than hand-firing, because the machines have not covered the whole of the grate," and that there is "a big thick fire at the front, and none at the back." "Engineer" is not the only one by any means who has made this discovery, but the fault lies not in the principle of over-feed firing, but rather in the inadequacy of the machines through faulty design, for the purpose for which they are intended. I have just inspected at one of our largest Thames-side engineering works a number of stokers of the overfeed type (but of a different design to those mentioned by "Radix") which appear to be free from the fault alluded to; though they have been in use over 10 years they are still working satisfactorily. The point, however, that struck me as being most extraordinary, was that, as the manager informed me, they had not only never given any trouble, but that they had cost practically nothing in repairs. Following "Engineer's" excellent example, I will not attempt any free advertisement of these machines, but being of an equally philanthropic nature, am prepared to supply anyone interested with the result of my inquiries.

It is certainly refreshing to find anyone with "Engineer's" 30 years' direful experience of stokers still retaining sufficient youthful enthusiasm to be eager to recommend an apparatus which he acknowledges he has only fixed to a boiler a few months ago. It would be interesting to hear his opinion after he has had a longer experience—say, for example, the three or four years' life that he gives the overfeed. I have myself known machines that, on one boiler, have shown most excellent results, and, as a consequence, have been fitted to all the boilers in a range; but deprived of the personal supervision given to the trial machine, and left to the tender mercies of an average fireman, they have quickly joined the majority on the scrap-heap.

A.M.I.M.E.

Some Items of Drawing-Office System.

In view of the large number of young engineers who are influenced by articles in the ELECTRICAL REVIEW, some of the statements contained in Mr. Lawrence's interesting contribution cannot be allowed to pass unchallenged.

Fig. 1 would appear to indicate that alterations to standard drawings are contemplated after they have already been used for the manufacture of machines or parts which have left the factory. Alterations should never be allowed under these circumstances, as, however much care is used in recording them, mistakes always result sooner or later. A drawing should show only one machine or part, any attempt to make it serve for future additions or modifications leads to confusion in the shops and errors in the office. Moreover, this method is unnecessary; it is generally quite as quick in the case of a small alteration to take two prints, alter them both, and file one as a record under a new drawing number.

As regards the numbering and storage of drawings, we are told by Mr. Lawrence that it is "useless simply to give new drawing numbers consecutively," and that the system of storage by rolling up on sticks which are placed in tubes is "cumbersome and extravagant of space."

The objection to numbering consecutively, is that drawings in connection with one subject or order are not kept together, and time is wasted in looking them up. On the other hand, if drawings are stored according to their subject matter, the drawers have to be constantly rearranged, and the labels altered as the numbers increase, hence the question of numbering resolves itself into one of storage.

Presumably Mr. Lawrence would not have so freely condemned the stick and tube system without having tried it, but it is difficult to understand how anyone can hold such an opinion who has changed over from storage in drawers to the method of rolling the tracings on sticks for insertion in racks of tubes. As regards space, the sticks and tubes occupy no more than the drawers if the number in the latter be limited to 50, and in the writer's opinion any greater number is very cumbersome.

A number of drawing offices have changed their storage to sticks and tubes, and in one case some 10,000 linen tracings are thus stored, with very satisfactory results. The quickness with which drawings can be found and referred to without disturbing their neighbours seems almost miraculous to those accustomed to drawer storage, and this featur

entirely does away with the objection to consecutive numbering as a dozen or more drawings widely differing in number can be collected in a few seconds.

Then, again, there is a definite place for each drawing, and it is almost impossible to put them away in their wrong places, as two drawings will not go into one tube.

The only drawback which can be urged against the system is the extra cloth necessary at the stick end to allow of printing without removing the stick. This is a small matter, however, and it is largely balanced by the need for making all drawings on full-sized sheets when stored in drawers.

We are told by Mr. Lawrence that paper tracings should never be doubled. Here, again, some difference of opinion exists. You cannot store paper tracings on sticks, and they are quickly damaged in drawers. The writer has stored 10,000 quite satisfactorily in trays interleaved with numbered pressspahn sheets, but, of course, they had to be doubled up. This doubling is not so serious as appears at first sight, as paper tracings should only be used for special work, and, generally speaking, prints can be taken before the tracings are creased, further copies being seldom needed. There is no perfect method of keeping paper tracings, but excepting for the creases the trays are very satisfactory.

These questions of alterations, numbering, and storage, are of extreme importance, and, in the writer's opinion, experience has proved that alterations are unnecessary and harmful, and consecutive numbering in conjunction with stick and tube storage offer distinct advantages over any other system.

The other points touched upon by Mr. Lawrence are not so important, and the methods may be varied to some extent without seriously affecting the efficiency of the drawing office.

W. O. Horsnaill.

Ipswich, *December 29th*, 1908.

New Year Conundrums.

One of our journals publishes regularly questions for practical men. The following are unpractical questions for unpractical men (query, imaginative specimens) :—

Why are electric lamps generally turned downwards and not upwards ?

Why are accumulators not more generally used ?

Why is there so much uncertainty as to charging for electricity ?

Why is electricity still in its infancy ?

E. H. H.

The Abolition of Letters Patent.

The most valuable articles in your last issue upon the subjects of the working and revocation of inventions have brought to the surface a view of the question which I have often turned over quietly in my own mind, and which I think might interest the readers of the Electrical Review. I will state my views briefly, and if they should prove of interest shall be pleased to enlarge at a later date. Science, literature, and travel have reduced the world to a small village, in which each inhabitant is in accord, communication, or personal contact with the rest. Inventors are discoverers, designers, or importers. The first are those valuable scientific workers who publish freely not only their results, but their various stages of progress and their methods. These never take patents and are not, therefore, within the meaning of the Acts, inventors. Secondly, the designers, when competent, only file specifications under existing customs (laws and customs are much the same thing) to try to prevent their competitors from imitating them too closely. In this they almost invariably fail. Only to give two reasons : that the cost in time and energy is usually too great to expose or arrest the imitator, also that a British patent only protects on an average one-fourth of a British manufacturer's market, probably it is less, so much is the Empire alone scattered and trade overseas. The "designer" incompetent is an unmitigated nuisance, the more so as he is not always easily detected and never self-revealed.

Imported inventions would, if Patent Laws were abolished, be superseded by home or imported manufactures, just which being governed as such things are "home or imported" under pertaining industrial conditions affecting to-day the greater bulk of trade.

As to the foreign patents of a Britisher, he might as well in ninety-nine cases out of one hundred save his money. It is similar to the home patent : "The easiest thing is to invent the thing, the rest is all difficult." The same business ability and business connection which is almost always indispensable to get the thing going at home or abroad, will bring any would-be inventor success of the real sort.

Manufacturers are not helped, I am convinced, as is supposed, or as they pretend, by the descendants of the Statute of Monopolies. Of a number of firms' licensees of the same patent, one or two will succeed while the remainder drop out. Why ? For certain reasons quite unconnected with patent protection.

As to the encouragement of ingenious application and advance in industrial production and the expectations of the new Act, I should say, if Austria can, with freight and language against them, beat us at our own doors, then there is a reason for which patent law is a poor line of defence by the men of a great nation like ours which wants to remain great.

England was the first to employ patents, at a time when it well suited our purpose. To-day does it serve our purpose, is it not industrially inefficient and unnecessary, and would the abolition of patents not prove a more masterly counterstroke than the building of walls to face those which our great neighbours have raised and which we call Protection ?

J. Sutherland Warner.

London, S.W., *January 5th*, 1909.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Grissonater.

This is a new type of interrupter for induction coils, giving powerful effects without appreciable wear of the contacts. It consists of a reversing commutator H and an electrolytic condenser G, connected as shown in the figure, the commutator being driven by a motor. The battery is connected to M, N, in circuit with the primary coil E, and A B C D are brushes bearing on the commutator. In the position shown, the condenser is charged until its pressure equals that of the battery. If now the commutator is turned through 180°, the connections are reversed, and the condenser is discharged abruptly through the primary coil, producing a high E.M.F. in the secondary; the current continues to flow in the same direction, charging the condenser, but as its magnitude decreases with the growing charge of the condenser, the rate of change of

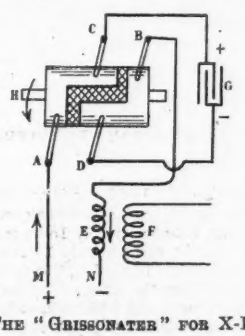


Fig. 1.—The "Grissonater" for X-Ray Work.

flux is much slower than during the discharge, and hence the secondary discharges are unidirectional—an important advantage for X-ray purposes. As the commutator rotates, the discharges follow uniformly, always in the same direction, in the primary and secondary coils; the circuit is interrupted at the commutator only when the condenser is fully charged in opposition to the battery so that no current is flowing and no sparks take place at the brushes. The condenser consists of a bath of bicar onate of soda measuring 25 × 25 × 30 cm., containing plates of aluminium connected alternately with the terminals like a storage battery; its capacity is 500 mfd., so that a powerful discharge is produced. With this apparatus, a relatively small battery is enabled to give radiograms of the thorax in a few seconds.

We are indebted for these particulars to *l'Industrie Electrique*.

New Auto-Transformer Switch.

The accompanying illustrations, figs. 2 and 3, show a new type of switch for use on transformer installations.

In fig. 3, A is a laminated core, having pole-pieces B, C and D; E is a laminated armature, pivoted at F. G is a contact plate with three conical dippers, arranged to enter the mercury cups H^1, H^2 and H^3. I and J are the actuating coils, I being wound with a large number of turns of fine wire, and J with a small number of turns of wire of a gauge suitable for carrying the maximum primary current required by the transformers.

The coils I and J are in series with each other, and with the lamps and transformer T. The high resistance coil I is also connected across the mercury cups H^1 and H^2, while the lamps and secondary of transformer are across the cups H^2 and H^3. The action is as follows:—When the first lamp is switched on, a circuit

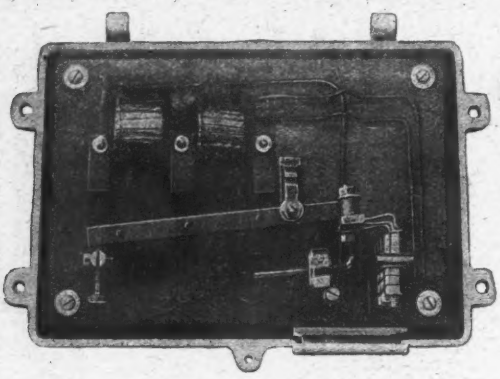


Fig. 2.—Dewhurst-Roscoe Automatic Switch.

is formed through coils I and J, lamp and transformer. The small resulting current, owing to the large number of turns in coil I, and the proximity of the armature to pole-pieces B and C, is sufficient to raise the armature E, and place the dippers in the mercury cups. The lamps are thus placed in the secondary circuit of transformer, and the high resistance coil I is shorted, but the armature having been raised against the pole-pieces C and D, the coil J is able to hold it in that position. The switching on of additional lamps increases

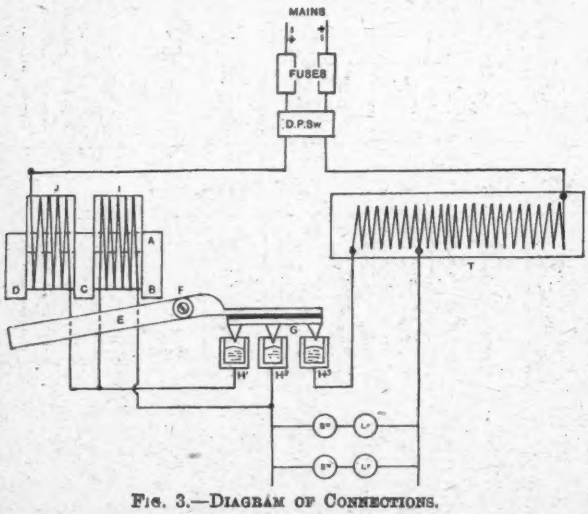


Fig. 3.—Diagram of Connections.

the attraction, but when the last lamp is switched off, the armature drops by its own weight, and the transformer is cut out. The switch will cut in and hold in with a 15-watt lamp in circuit, and the voltage loss due to the coil J is only 1 per cent.

The switches are enclosed in neat and substantial iron cases, with bushed holes for admitting the connecting leads, and the requisite quantity of mercury is sent out with each switch.

The switch has been provisionally patented by Messrs. Dewhurst and Roscoe, and is being manufactured by Mr. E. Dewhurst, Mount Street Works, Preston.

Transformer Switch for Metal Filament Installations.

Messrs. Morris & Lister, of Carlton Works, Coventry, inform us that they are about to place on the market the "Bruston" automatic switch, which fulfils all the requirements necessary for a switch for metal-filament auto-transformer installations. The switch is operated by a low-voltage current, which is started when the first lamp of the installation is switched on. The construction is such that the act of switching on breaks the low-voltage battery circuit which operates the switch. The current of a single lamp is sufficient to hold on the switch, and on the last lamp being switched out the automatic switch will break circuit.

In addition to the "automatic" features, this switch possesses a distinct advantage over other switches designed for the same purpose, in that the full pressure of the mains is not impressed on the low-tension wiring system when the switch is off.

Messrs. Frampton & Paine, of 29, Old Queen Street, Westminster, who are the selling agents, will be glad to give further information to any of our readers who may be interested.

The "Beaver" Stock and Die.

The American Mill Supplies Co., Ltd., of Rochester Row, S.W., who are southern agents for the Oldbury Steel Conduits, Ltd., have introduced to this country the "Beaver" stock and die (fig. 4), a device which is calculated to save both time and expense where much conduit has to be screwed.

Briefly, the Beaver stock, in the case of the small die-stock

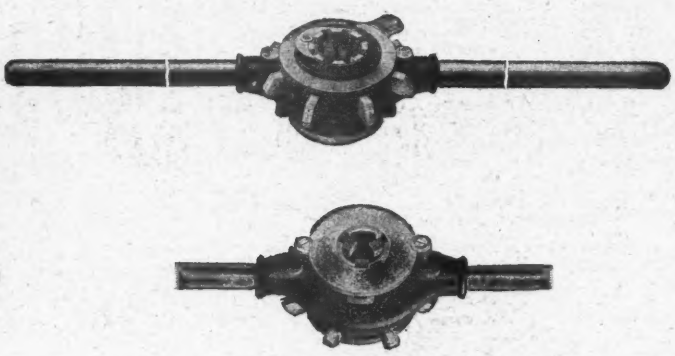


Fig. 4.—Beaver Stock, Front and Rear Views.

(No. 7) which screws ½, ⅝, ¾, ⅞ and 1 in. threads, is fitted with two sets of dies, either of which is automatically adjusted to the requisite positions by simply moving a projecting lug, which shifts the dies by a cam mechanism. The mechanism is entirely self-contained; the dies are held when set by a special lock, and owing to their being contained in the stock and not removed, the risk of losing or misplacing them is avoided.

The Beaver dies are narrow, and in the case of the larger sizes, which cut up to 4-in. threads, are arranged to start on the end of the pipe at full depth of cut, and automatically recede as they travel on to the pipe, so as to produce a tapered thread.

It is claimed that the narrow dies greatly facilitate threading operations, and that the devices, especially in the smaller sizes, are so reasonable in price, as to be well worth the consideration of anyone using much conduit.

Drilling Tramway Rails.

The apparatus shown in the accompanying illustration, fig. 5, was utilised in 1907 on the Falkirk and District Tramways Co. by Mr. E. S. Conbadi, as construction engineer for the contractors, Messrs. Bruce Peebles & Co. The whole apparatus consists of a 10-12-h.p. motor-car, a flexible shaft, drill and drill cramp. The flexible shafting was attached to the boss of one of the motor-car wheels by a universal union, the wheel being raised a few inches off the ground by packing.

The idea of the above arrangement was to find an expeditious method of boring the rails for the reception of the drain boxes without in any way interfering with the tramway service, as a number of the drain boxes had to be fitted after the tramway

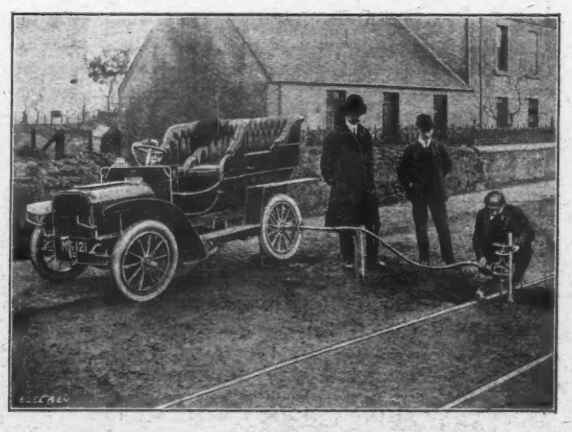


Fig. 5.—Mr. Conbadi's Portable Drilling Outfit.

service had started. As a good deal of the line was single track, with a five-minute car service in either direction, there was very little time for the drilling work to be carried out by the ordinary hand ratchet method.

With the apparatus shown, a hole could be put through the rail easily within a minute, and though there were 10 holes for each drain box the work was effected very expeditiously, consequently at a comparatively small cost and without any inconvenience to the tramway service.

The idea does credit to Mr. Conradi's ingenuity and fertility of resource, and may be of service to other engineers.

Patent Economiser Air Excluder.

The accompanying illustrations show the Ogden patent economiser air excluder, which has been introduced by Messrs. Ed. Bennis & Co., Ltd., of Little Hulton, Bolton, to provide means for preventing cold air from entering the interior of an economiser through the chain holes. It is a simple and efficacious device for fixing over the economiser chain holes, and is so contrived that while it stops the air leakage, it requires no attention, there being no parts that can possibly get out of order. Moreover, the apparatus is stationary and the adjustment simple. It has been calculated that in an average installation about 1 per cent. of the fuel is wasted through air leakage *vid* the chain holes, so that the small cost of the appliance should be quickly repaid by the saving effected, and in addition the value of the economiser greatly enhanced.

Thus, suppose that an ordinary Lancashire boiler is burning say 26 tons weekly, at 8s. per ton; 1 per cent. would mean 2s. a week, or over £5 per annum.

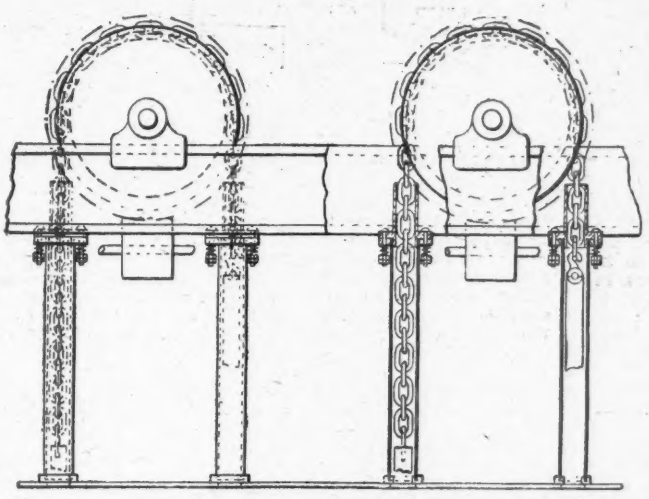


Fig. 6.—Ogden Air Excluder for Economiser.

Fig. 7.—Details of Air Excluder.

Messrs. Ed. Bennis & Co., Ltd., have secured the sole rights for the manufacture and sale of the apparatus, and are prepared to fit it to all types of existing economisers.

A reference to the illustrations, figs. 6 and 7, will afford a clear idea of the apparatus.

The Marconi Multiple Tuner.

Amongst the new apparatus shown at the Physical Society's Exhibition was the "multiple tuner" recently introduced by Messrs. Marconi's Wireless Telegraph Co., Ltd., and briefly noticed in our review of the exhibits (in which, unfortunately, we gave the range of wave-length as 300 to 800 ft., whereas it is 300 to 8,000 ft.). The accompanying illustration shows the complete instrument, which represents the result of many years' experimental work, and has been designed with an eye not only to electrical efficiency but also to mechanical robustness and ability to stand all climates.

The principal function of the instrument is to "tune" the receiver, or render it immune to interference from other stations, but it may also be used for measuring the lengths of the transmitted and received waves and for estimating the distance of a known station. It is completely protected from all electrical discharges, and is adequately insulated wherever required, while all the switches and contacts are of the most substantial character and easily accessible for cleaning. Further, it is strongly constructed, and all electrical connections are carefully soldered, so that it is unaffected by the severest vibration.

The general principle of the instrument is shown in fig. 9, in which A represents the aerial, E the earth, R the receiver or detector, and the dotted line encloses the instrument proper. The instrument contains three separate circuits, called the aerial circuit, the intermediate circuit and the detector circuit.

The aerial circuit passes from the aerial A, through the aerial tuning inductance I, aerial tuning condenser C_1 and aerial inducing inductance P_1 to the earth at E. The intermediate circuit consists of two equal inductances S_1 and S_2, connected in parallel to the intermediate tuning condenser C_2. The detector circuit consists of an inductance P_2 in series with the detector tuning condenser C_3 and detector R.

The inductances I and P_1 are adjustable at B and D respectively, and the condensers C_1, C_2 and C_3 are all adjustable, and by means of these adjustments all the three circuits are tuned to the received wave length. The oscillations in the aerial circuit then induce (by means of P_1 and S_1) oscillations in the intermediate circuit, which in turn induce (by means of S_2 and P_2) oscillations in the detector circuit. In addition to the above adjustments, the two coils S_1 and S_2 may be moved relatively to the coils P_1 and P_2, so that the couplings between the three circuits may be varied.

The condensers C_1, C_2 and C_3, are constructed upon a new principle and are continuously variable from zero to a maximum of 10 jars (a jar being 1,000 centimetres), but the range of the instrument is increased by other condensers placed in parallel or series by means of the tuning switch.

In addition to the parts shown in this diagram, the instrument is fitted with a micrometer spark gap and shunt inductance (of the order of 80,000 microhenries) connected between the aerial and earth terminals to prevent the accumulation of an electrostatic charge in the aerial, with a change switch by means of which the whole of the tuned circuits may be cut out, and with a tuning switch by means of which the capacity in the intermediate and detector circuits may be increased to a maximum of 30 jars.

E

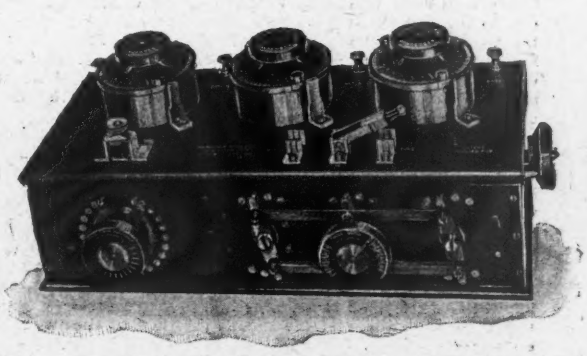


Fig. 8.—Marconi Multiple Tuner.

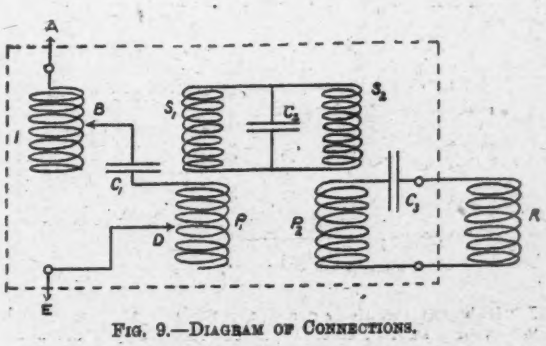


Fig. 9.—Diagram of Connections.

PROCEEDINGS OF INSTITUTIONS.

Using Transformers as Choking Coils.

By J. D. COALES, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Birmingham, December 16th*, 1908.)

IN designing transformers, the flux density is chosen with a view to obtaining the smallest core losses and no-load current compatible with economy in material, and the smallness of the no-load current

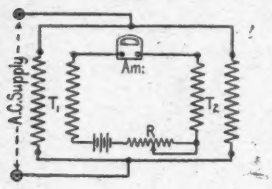


FIG. 1.

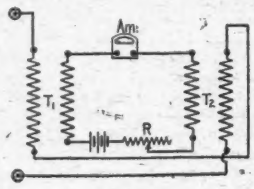


FIG. 2.

renders a transformer useless as an inductive load at the voltage for which it is designed, unless by some special means the current can be increased to a reasonably large value. In core transformers with butt joints, this may be accomplished by temporarily opening the joints, but this is not a satisfactory plan for workshop uses. The present paper deals with a method of reducing the permeability of the core of a transformer, and thereby increasing the magnetising current, by bringing the flux density in the core up to a suitable point in the magnetisation curve with the aid of direct current sent through the secondary winding. Thus, when an alternating E.M.F. is applied to the primary, the flux density is varied about a mean value corresponding to low permeability.

It is evident that something must be done to prevent the secondary E.M.F. from driving an alternating current through the source of direct current; two ways of doing this are shown in figs. 1 and 2. In the former, the primaries of two similar transformers are connected in parallel, and the secondaries in opposition, in series with the source of direct current; in the latter the primaries are in series, and as the inductance of the second arrangement is double that of the first, by the use of both a wide range of inductance is obtained.

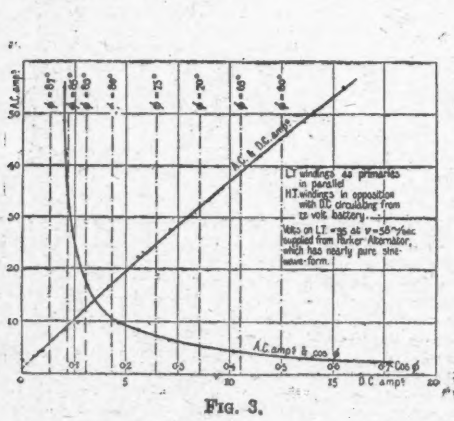

A.C. & D.C. amps
LT windings as primaries in parallel
HT windings in opposition with D.C. circulating from 12 volt battery
Volts on LT = 95 at n = 50 ~/sec supplied from Parker Alternator, which has nearly pure sine-wave-form.
A.C. amps & cos φ
D.C. ampt

FIG. 3.

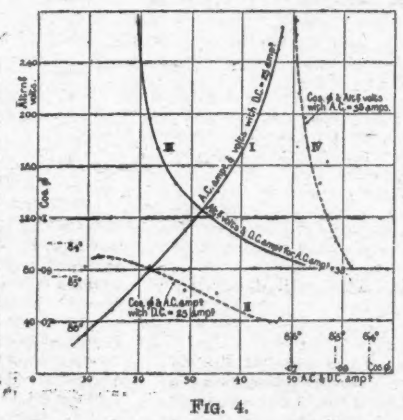

Alternt volts
Cos φ
A.C. amps & volts with D.C. = 15 amps
Cos φ & Alt.E volts with A.C. = 50 amps.
A.C. amps & D.C. amps for A.C. amps = 35
Cos φ & A.C. amps with D.C. = 25 amps
A.C. & D.C. amps
Cos φ

FIG. 4.

Fig. 3 shows the relation between the alternating current taken by such an arrangement and the direct current used to vary the inductance, as well as the power factor and angle of lag. The full-load alternating currents were 37·5 and 64·6 amperes in the H.T. and L.T. windings respectively, the latter being in parallel.

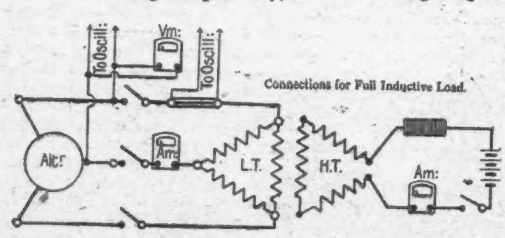


FIG. 5.

It will be seen that the A.C. and D.C. readings are connected by a very nearly straight line law, at constant A.C. pressure and frequency.

In testing alternators for "drop" on inductive loads, it is necessary to take into consideration the wave-form of the current; an investigation was therefore carried out, and showed that while the current waves in the individual transformers were distorted, the curve of total current was practically sinusoidal at 50 amperes (less than 40 per cent. of the full-load value for the two transformers). The E.M.F. wave of the alternator was very nearly a pure sine wave. Experiments were made with a larger alternator having a slotted armature core, and with the two L.T. windings connected in series, with similar results. For any current above 25 per cent. of the full-load current the wave-form is sufficiently near a sine curve for practical purposes. It was found also that the direct current was thrown into ripples by the superposition upon it of an induced alternating current having twice the frequency of the applied voltage, but the watts thus induced in the D.C. circuit did not exceed 45 when any power up to 1,400 watts was supplied to the A.C. circuit, at a maximum of 83·7 amperes. The A.C. voltage in the D.C. circuit is due to the lack of symmetry in the successive half-waves in the two windings connected in opposition. The amount of power thus transmitted was only 0·3 per cent. of the volt-amperes of the transformers for full-load current, and was therefore negligible. With full-load current the core losses are about 6 per cent., and the total losses when used as choking coils are 7·4 per cent., about 2·7 times

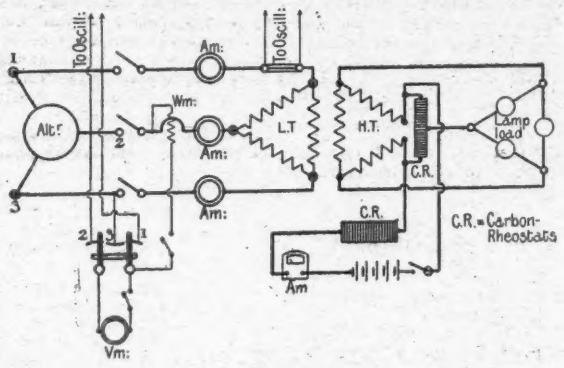


FIG. 6.

the normal losses of the transformer. When the voltage on the A.C. side is that normal to the transformer, and the maximum range of flux density is also normal, the ratio of the alternating to the direct current is approximately equal to the ratio of transformation.

Tests were made with constant current and variable voltage, of which the results with L.T. windings in series are shown in fig. 4. With the direct-current constant and the A.C. voltage varied, the resulting alternating current at first varied roughly as the applied voltage, but later tended towards a constant value. This property is the reverse of what occurs in an ordinary choking coil, and is due to the fact that as the voltage increases, the wider range of flux variation brings the flux density during half the cycle into a region of high permeability, which more than compensates for the decrease of permeability during the other half cycle. When the alternating current was kept constant (Curve III), the direct current diminished as the A.C. voltage increased.

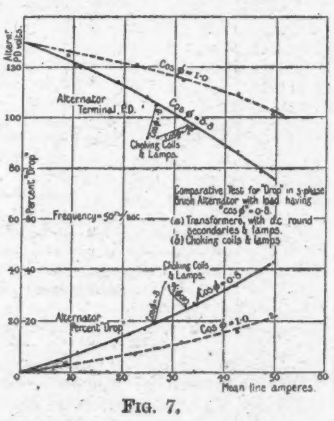

Alternt' PD volts
Alternator Terminal P.D.
Choking Coils & Lamps.
Alternator Percent Drop
Frequency = 50 ~/sec
Comparative Tests for "Drop" in 3-phase Brush Alternator with load having cos φ = 0·8
(a) Transformers, with d.c. round secondaries & lamps.
(b) Choking coils & lamps
Choking Coils & Lamps.
Mean line amperes.

FIG. 7.

In the case of single-phase alternators, full inductive load tests can be carried out with transformers arranged as described above. In the case of three-phase alternators, if six transformers are available, loads of good wave-form may be obtained by making up three single-phase pairs connected as in fig. 1 or 2, and combining these in star or mesh groupings with the direct current sent through the six secondary windings in series, or each three-phase set may be star connected, and the two sets connected in parallel with the secondaries opposing each other as in the Kapp-Sumpner test applied to three-phase transformers. The source of direct current is then connected between the neutral junctions of the two sets of secondary windings.

It is of great convenience to be able to use the high-tension windings for the direct-current circuit, for then the strength of the direct current required is proportionately reduced.

There are several methods of arranging the direct-current circuit in star and mesh-connected transformers, and it is possible to superpose the direct current upon the alternating current in the primary windings in such a way as to avoid any circulation of

direct current through the alternator circuits. This is equally true both for full inductive and partially inductive loads. In the tests described only three transformers were available, and mesh connection was adopted for both the primary and secondary windings of the transformers. The direct current was caused to circulate round the secondary mesh consisting of the high-tension windings, by opening the mesh at one corner and inserting a battery, carbon rheostat, and ammeter. As there is no alternating electromotive force round such a mesh, under ordinary circumstances the direct-current circuit would experience no alternating current of any magnitude. However, should such circulating currents occur through dissymmetry produced by the artificial saturation of the cores, it may be reduced to a negligible amount by means of an ordinary choking coil inserted in the direct-current leads.

The connections when the transformers were used as above described are shown in fig. 5.

After completing the test the alternator leads were transferred to three ordinary choking coils connected in mesh, and the test repeated under the same conditions.

A comparison of the two sets of curves showed that the difference in the effects upon the alternator of the two methods of obtaining an inductive load is not serious, though the alternator had to be run at reduced excitation, so that any such effects would be exaggerated. As the wave forms were found to be considerably distorted, it would seem that the mean value of armature reaction is much more important than its distribution throughout the cycle.

Tests were also made for "drop" with a partially inductive load, having a power factor of 0·8, the non-inductive load consisting of lamps, as shown in fig. 6. The results, so far as they could be compared with tests in which choking coils were substituted for the transformers, were in close agreement with those of the latter (fig. 7).

The author suggests that when special choking coils are constructed on this principle, a double magnetic circuit be used, having three cores, of which the middle one has double the cross-section of the outer cores. The primary winding should consist of two equal coils placed upon the outer cores and connected so as to magnetise the rectangle formed by the outer cores and yoke in the same sense. The direct-current winding or secondary should then be placed on the middle core, so that when excited it magnetises the two outer cores in parallel, while it is itself uninfluenced by the alternating magnetic flux produced by the primary windings. By this means half the copper required for the direct-current windings, when two transformers are used, is saved.

Discussion.

DR. W. E. SUMPNER (Birmingham) said that he did not feel confident, from the author's statements, that the use of transformers as choking coils was promising. The core losses were very large, and the difficulty of keeping the transformers cool might prevent their being used successfully as a load for large alternators. An interesting point was that when compound excitation was used the mean flux was much less than that caused by the D.C. excitation alone. The statement that cos ϕ had no definite meaning unless the currents were truly sinuous was incorrect, for the expression when equated to the power factor yielded a value for ϕ, which had a precise meaning in connnection with vector figures, however irregularly the currents and voltages varied. Referring to Dr. Coales's experimental result that the average self-induction of the transformer coil was inversely proportional to the strength of the direct current used for the excitation, a very usual definition of self-induction was that given by the equation, $L\,p\,A = V$, where V stood for the voltage and A for the current of a choking coil, and where p was proportional to frequency. For a choker excited, like those of DR. COALES, at constant voltage and frequency, the product L A would be constant, and as Dr. Coales found in his tests that the alternating current A was approximately equal to the direct current he used, the result he found merely expressed the fact that he was using constant voltage.

MR. S. P. SMITH (Stafford) remarked that the oscillograms showed clearly that the current wave approached more nearly to a sine wave as the saturation increased, the reason being that the effect of the iron diminished at such high flux densities. He also discussed the various harmonics present in the curves of wave form.

DR. D. K. MORRIS (Coventry) said that, since the work by Messrs. Morcom and Walshe, the cost of the necessary apparatus, if choking coils were used, might be said to be reduced to somewhere about one-tenth of what it formerly cost. The author stated that a test could be run for four hours, using the transformers designed for working with the generator under test, but he thought it would be found that the test could not be run more than about half an hour without causing overheating. This would, however, permit of the regulation of the alternator being tested. A disadvantage was the very low D.C. voltage required, which would, in most cases, mean special cells or generators. The use of direct current permitted an easy adjustment of the alternating current when working with constant voltage.

MR. A. R. EVEREST (Rugby) was unable to understand the suggested large increase in iron loss for the same voltage and frequency, when the flux pulsation was superposed upon an initial magnetisation produced by D.C. excitation. He had designed reactance coils for use in a rectified series circuit on the assumption that for the same frequency and total range of flux variation, the core loss will be the same as if the total range of flux variation were divided equally above and below the neutral point, and the heating tests made on these coils confirmed this assumption.

DR. G. KAPP said that the cost of providing a suitable supply of direct current should be less than that due to providing special choking coils. The important question then was whether a transformer used in the way suggested would get too hot in too short a time. But even taking the statement in the paper that the core loss is increased by 40 per cent. over the normal, he still believed the method could be used commercially. The heat capacity of an oil-cooled transformer was enormous, and such a transformer could be run for 6 hours under the conditions required by the test, without a greater temperature rise than 50° C. He, therefore, believed the test to be commercially possible, particularly as most alternators reached their final temperature in 6 hours.

DR. J. D. COALES, in reply, said that his original intention was to suggest the use of such inductive loads merely for regulation tests of alternators; but a 4 hours' run at full inductive load was possible with ordinary cooling conditions, and a 10 hours' run with full load of power factor = 0·8. With temporarily increased cooling conditions the period might be increased to 6 hours, thus rendering a full inductive load test possible. The irregularity of the alternating-current wave form in one of two parallel connected primaries, with artificially saturated cores, was compensated for by a similar irregularity of opposite sense in the other primary, with the result that the alternating current flowing into the pair was symmetrical. Where three Δ connected transformers were used, this irregularity was, however, not eliminated, and it was for this reason that comparative tests were made with choking coils of good ordinary designs, in order to show that the irregularity was unimportant in testing alternators. Since it was found that with constant alternating voltage the direct and alternating currents were proportional to each other, then the mean coefficient of self-induction must vary inversely as the direct current. This inverse relationship was still true if the alternating voltage was varied within limits. It was due to the physical qualities of the iron, and not to the mere external conditions of the test. With regard to the question of core losses, it had to be remembered that the strong saturation of the core by the direct currents tended to promote leakage, and that this probably caused unusual eddy-current losses in the copper of the windings and in the unlaminated iron work in the neighbourhood of the core.

The Faraday Society.

THE autumn session of the Faraday Society opened on Tuesday, December 15th, when a varied programme consisting of four papers gave rise to interesting discussions.

"The Electrolytic Potentials of Silver and Thallium," which have lately been redetermined by DR. F. J. BRISLEE, formed the subject of the first communication. It is perhaps difficult to work up enthusiasm about the measurements of physico-chemical constants, but it is necessary for the progress of science that these should be made, and made, too, with extreme care, and Dr. Brislee's experiments have been carried out with just that precision and minuteness which such determinations demand. The electrolytic potential E P is defined as the potential of a metal against a normal ionic solution of the metal, and it is given numerically by Nernst's equation, which at 17° C. (the temperature at which Dr. Brislee worked) becomes—

$$E\,P = \underset{electrode\text{-}electrolyte}{\epsilon} - \frac{0{\cdot}058}{n}\log_{10} C.;$$

ϵ, of course, is here the potential difference between the electrode and a solution of concentration C, and n is the valency of the metal in solution. The E.M.F. measurements were made with a Clerk Fisher potentiometer, employing a Weston cadmium cell as standard and the decinormal calomel electrode as comparison electrode, the liquid potential at the junction of the two being eliminated (as is now usual in such experiments) by a saturated solution of ammonium nitrate. The ionic concentrations were calculated from the best available conductivity measurements. The determinations were made over a wide range of concentrations and in solutions of two different salts, in the case of silver, nitrate and acetate solutions, and in the case of thallium, nitrate and chloride solutions. The mean results obtained were: for silver, + 1·0757 ± 0·0006 volt; and for thallium — 0·0425 ± 0·0005 volt.

"The Heats of Combustion of Aluminium, Calcium and Magnesium," by MR. F. E. WESTON and MR. H. R. ELLIS, is a continuation of the authors' study of the "thermit" method, as it may conveniently be called, of reducing metallic oxides, they having investigated the reduction of the oxides of aluminium, calcium and magnesium respectively, by each of the metals magnesium, calcium, and aluminium. It was found that (1) alumina is reduced by magnesium and calcium; (2) lime is easily reduced by magnesium, but only partially by aluminium; (3) magnesia is not reduced by aluminium, and but slowly by calcium. The conclusion, based on the theory of greatest heat development, that the heat of combustion of magnesium is greater than that of calcium, and calcium than that of aluminium is, perhaps, hardly justifiable, in view of the complexity of the reactions, the formation of suboxides, and complications introduced by the presence of air. The authors are, however, repeating these reductions *in vacuo*, and they hope thereby to throw more exact light on what are undoubtedly interesting and what may even prove to be important reactions. It has, for example, been suggested that if, as seems possible, alumina and aluminium sulphate could be brought under conditions favourable for their interaction, the method may prove to be a new source of aluminium, and there are similar possibilities in many of the cognate reductions which Messrs. Weston and Ellis are doing good service in drawing attention to.

The study by MR. H. R. ELLIS of "The Formation of Graphite by the Interaction of Magnesium Powder and Carbonates" is on similar lines to the work described in the previous paper. The author has found that the black powder produced when

magnesium powder reduces metallic carbonates—as it does readily—invariably contains a predominant proportion of graphite, as well as a certain amount of amorphous carbon, and in some cases the carbon formed consists almost entirely of graphite. The carbonates studied were those of barium, calcium, strontium, ammonium, magnesium, and cadmium. The author is of opinion that in all cases amorphous carbon is first produced, but that the enormous heat evolved by the reaction, converts this into graphite.

"Colloidal Barium Sulphate." An interesting and suggestive paper with this title was that read by DR. ERNEST FEILMANN. The colloidal form described is prepared by adding barium chloride to a mixture of sodium sulphate and an alkali casein solution. This gives a thick creamy liquid, and from it the barium sulphate is precipitated by acetic acid. The precipitate, after washing, dissolves in a very dilute alkali to form a milky colloidal solution, from which a translucent horny mass, containing 56·7 per cent. barium sulphate, is obtained on evaporation. Under a magnification of 200 diameters, particles in rapid movement can be made out under the microscope. There is evidence to show that the "colloidal" particles consist of a nucleus of barium sulphate surrounded by a protective layer of true colloidal casein. Prof. W. W. H. Gee in the discussion, suggested that the coating may form an electric "double layer," which prevents neutralisation of the nucleus by oppositely-charged ions. The whole subject of colloids, is one which is deserving of further study than it has hitherto received, and it should become fertile in technical applications. One speaker, for example, suggested that the colloidal, instead of the ordinary variety of barium sulphate, might advantageously be used for coating the inside of uniform reflecting surfaces, such as are used in some forms of photometric apparatus. It was with this stimulating object in view, that Dr. Feilmann brought forward his preliminary communication, because his work on the subject is by no means yet exhausted.

SURGE PRESSURES.

THE conditions of resonance in a distribution system cannot be determined by calculation, because one does not know beforehand the harmonics of the machines, nor the capacities or self-inductions of the apparatus. Besides, these quantities vary constantly with the number of machines feeding the system, the length of the lines and the number of motors, &c., which are at any one time in operation. Calculation, therefore, is illusory, and the only thing to be done is to find some means of suppressing or making harmless the surge pressures whenever they are produced.

In a great number of cases, arrangements are adopted in which spark-gaps are placed in series with resistances.

If, in fig. 1, the winding of the transformer T has a self-induction L and a capacity C to earth, and if, further, R is the resistance and P the spark-gap, then the circuit formed by P R C T is an oscillatory circuit, absolutely identical with the circuit employed in wireless telegraphy in order to produce high-frequency impulses; and if certain conditions are fulfilled, the operation of the spark-gap P will force the high-frequency currents into the transformer. If we have $CR^2 < 4L$ there is resonance, and the current is oscillatory.

If, on the other hand, $CR^2 > 4L$ resonance does not exist. If the resistance R is too small, high-frequency currents are produced, and almost the whole of the voltage of the high-frequency current must be absorbed in the first few turns of the transformer, with

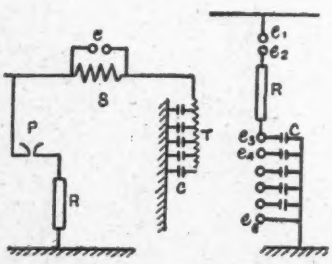


FIG. 1.

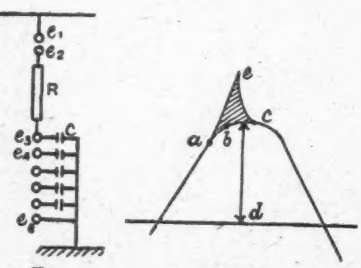


FIG. 2.

FIG. 3.

perforation of the winding as a probable result. If the resistance is sufficiently large, the high-frequency currents are suppressed, but the capacity of the arrangement will not be sufficient to deal with surge pressures of any magnitude.

The difficulty can be overcome by the use of the electric valve.

The apparatus consists of a first spark-gap e_1, e_2 (fig. 2) in series with a resistance R, and a number of spark-gaps e_3, e_4, &c., to e_5. The spark-gaps e_2 to e_7 are indirectly connected to earth through small condensers, whilst the last spark electrode e_5 is directly connected to earth.

Let us suppose that the line has a normal pressure of 10,000 volts and that the first spark-gap is regulated to come into action at 12,000 volts. The first knob e_1 is at a potential of 12,000 volts; all the other knobs, e_2, e_3 to e_5 are maintained at zero potential through the small condensers.

The pressure of a surge of 12,000 volts produces a small spark between e_1 and e_2, so that the knob e_2, which, at first, was at zero potential, will now be at a potential of 12,000 volts, less the pressure drop in the spark-gap.

The current which actually passes in the spark is very small, being only of the magnitude which can pass through the small condenser, so that the drop in the spark-gap will not be great, say about 500 volts; therefore, the knobs e_2, e_3 will have a potential of 12,000 minus 500, or 11,500 volts. The knob e_4 is still at zero potential, and the spark will now jump between e_3 and e_4, bringing the potential of e_4 to 11,000 volts, and so on through the series of knobs, so that the sparks pass, as it were, in cascade, until they reach knob e_5, which is metallically connected to earth. As soon as the last spark-gap e_1, e_2, is in operation, a discharge can pass from the line direct to earth.

The resistance R is sufficiently great to avoid the production of high-frequency oscillations, and, therefore, the apparatus may be insufficient to deal with the surge pressure produced in a large distribution system. We can, however, increase the capacity of the

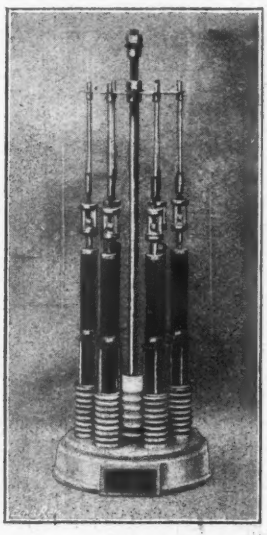


FIG. 4.—ELECTRIC VALVE.

valve to any extent by placing several columns as above described in parallel; it has been found that each column operates independently of the others, and since the various columns cannot be regulated to exact uniformity, they will not start working at the same instant.

If, in fig. 3, the pressure begins to rise, say, at point *a*, one of the columns or valves will come into action, and if its capacity is insufficient, the voltage will continue to rise and will possibly arrive at point *b*, where the second valve will operate, and possibly the third valve will come into operation. If three columns are sufficient to carry away the surge pressure, then the pressure cannot increase beyond the value *c d*, and from this point onward it will drop again; one has thus suppressed the peak which would have been formed otherwise (*a e c*). Supposing that we had shown that a resistance of 10,000 ohms was sufficient to avoid the production of high-frequency phenomena, and that we had 10 columns in parallel, then we would have only 1,000 ohms equivalent resistance between the conductors and earth, and yet from the point of view of high-frequency generation, the result would not be the same as if we had put a single column with 1,000 ohms resistance in series. In fact, since the valves come into operation one after the other, we have a gradual discharge, and the aggregate of valves does not produce an oscillatory phenomenon which would otherwise certainly be obtained with a single column, having a resistance of 1,000 ohms only. It has been found that no matter what is the number of columns in parallel, no high-frequency effects are produced, provided that the resistance of each column is sufficiently great. Since the terminal pressure at the valve sinks very little below the voltage for which the spark-gap e_1, e_2 is adjusted, the sparks cease spontaneously without having recourse to any blow-out arrangement; the valve thus does not act during the whole period, but only during the time in which the surge pressure occurs, and its effect is to cut off from the voltage curve all the peaks which are beyond the value for which it is regulated.

The practical form of the valve, as made by Messrs. Isenthal and Co., is shown in fig. 4. This valve not only serves to suppress the peaks of the voltage curve (resonance phenomena produced in the line by changes in the load), but also carries away the energy stored in the alternators or transformers at the moment when a short circuit is broken, and affords protection against atmospheric discharges.

The characteristics of this apparatus are thus the following:—(1) The absolute prevention of high-frequency currents. (2) With the arrangement based on the horn-arrester system, once the arc is started it will maintain itself during the whole period, until the blowing-out effect is produced. The result is that if we have a peak in the voltage at each period, and assuming for instance the existence of a harmonic of the pressure, then the arc will never cease. Under these conditions, even with resistances of great bulk, the heating will be so considerable as to cause the rapid destruction of these resistances.

For this reason one must allow considerable excess of pressure when adjusting horn arresters. The valve, on the other hand, only

takes off the peaks of the voltage—that is to say, an inconsiderable amount of power.

(3) The adjustable spark-gaps of the valve are enclosed in glass cylinders, and one need not fear that by the introduction of dust between the knobs, the apparatus will come into operation at inopportune times. Moreover, the operation of the valve does not involve any inconvenience, since the automatic extinction of the arc takes place before the end of the period in which it commences.

Finally, the whole of the apparatus is enclosed in a box which takes very little room even for large capacities.

BUSINESS NOTES.

Trade in 1908.—The *Chamber of Commerce Journal* for January contains a full review of the course of trade in various departments during last year. One of the sections deals with the Electrical Trade. Reports are published from all important industrial centres in the kingdom.

Book Notices.—*Die "Elektrische."* By Paul Scharlott. Leipzig: Carl Scholtze. Price M. 1 75 pf.—This book is written by the engineer of a large German tramway system as a popular guide to the various electrical and mechanical processes met with in connection with electric traction. It assumes no previous electrical knowledge, and is more especially addressed to the tramway *personnel*, for, as the writer points out, a fuller knowledge of the principles underlying their work is not only of personal advantage to themselves, but tends to improve the working of the whole system. There are 14 chapters, of which the first three explain preliminary electrical conceptions and the elements of electric traction. Chapter IV describes the apparatus in the generating station; Chapters V, VI and VII deal with the feeder system, the overhead system, and the rail system; Chapters VIII and IX deal with the rolling stock; Chapter X with hand, electric and air brakes; Chapter XI with the modifications involved in suburban and main line electric traction; Chapter XII deals with traffic regulations; Chapter XIII with faults on the overhead system, the feeders, the rails and the cars, and Chapter XIV contains abstracts of various German laws referring to electric traction. With the aid of the numerous good illustrations and the descriptions given, anyone in a position to examine the apparatus, &c., dealt with, will find this book of considerable use in clearing up difficulties, although, of course, very full information cannot be expected in so small a space.

"Science Abstracts." Sections A and B, December 28th, 1908. Vol. II, Part 12. London: E. & F. N. Spon, Ltd. Price 1s. 6d. per section.

Catalogues and Calendars, &c.—THE GENERAL ELECTRIC CO., LTD., of Queen Victoria Street, E.C., are once again favouring their friends with a new year souvenir. It takes the form of a Pilot Memo tablet on a neat polished stand, for the year 1909. You can make your daily notes and pass the slip over to the left with ease and without any tearing, each slip reminding you of something or other made by the company.

MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton, have sent us a glass paper weight with a backing representing a sectional view of one of their cables.

To the D.P. BATTERY CO., LTD., of Bakewell, Derbyshire, we are again indebted for a hanging card of very artistic design. A photographic reproduction shows a general view of the company's works and estate seen from the dam which serves the water-wheels. A calendar with monthly slips is attached at the left-hand corner.

MESSRS. CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., of Hamilton House, have issued a well-designed card showing the entire year in small form beside a coloured picture of H.M.S. *Indomitable*, in which ship the main electrical distribution is effected by means of Callender's cables and special boxes.

MESSRS. J. HALDEN & CO., LTD., of 8 and 9, Great Chapel Street, Victoria Street, S.W., have sent us one of their 1909 hanging calendars with dates boldly printed on monthly sheets, at the bottom of which appears a view of their continuous photo-copying machine.

From MESSRS. NORTON & GREGORY, of Castle Lane, Buckingham Gate, London, there has come to hand a well-printed calendar for 1909 with monthly sheets and bold dating in violet.

MESSRS. SIMPLEX CONDUITS, LTD., of 113-117, Charing Cross Road, W.C., have hit upon the idea of publishing an electrical engineers' diary for 1909. It contains a good deal of general electrical information in tabular and other form, after which one comes to the diary section, where adequate space is allowed for daily notes. The interleaved blotting might have been improved had it been free from advertisements, but we have no doubt the book will form a shelf or desk companion for many an electrical engineer or contractor during the coming year, in spite of that.

MESSRS. SIMMONDS BROS., LTD., 4-8, Newton Street, High Holborn, W.C.—Catalogue dealing with the firm's "Niphan" system of couplings and plugs for electric cables, and movable armoured installations, already known to the trade, but in the prices of which reductions of about 25 per cent. are announced. A list of a number of electrical contractors, electricity supply authorities, collieries, engineering firms, and others who have adopted the system, has also been received.

MR. G. WUTHRICH, Norfolk Street, W.C.—Leaflet tabulating sizes, prices, &c., of three-phase variable-speed Oerlikon motors from ½ to 20 H.P., for pressures up to 500 volts 50 cycles.

MR. L. HERVE, of 90, Clerkenwell Road, E.C., has in circulation a large wall calendar which consists of monthly slips on either side of which are small illustrations of various screws, &c., of many sizes, manufactured by him.

THE BRITISH GRIFFIN CHILLED IRON AND STEEL CO., LTD., of 139, Cannon Street, E.C., have produced an effective hanging card calendar with plainly printed monthly slips placed between two views of their cold rolled steel axles, wheels and other manufactures.

From MESSRS. B. GIBBONS, JUN., LTD., and MESSRS. GIBBONS BROS., LTD., of Dibdale Works, Dudley, we have received a desk blotting pad with a diary at the left hand on the pages of which there are spaces left for the working days of the week, with the current month's calendar at the top. The weekly slips are perforated for removal when done with. Each sheet of blotting paper has drawings or illustrations of some of the classes of manufactures supplied to, or work done for, gas and electric light undertakings and public authorities.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, S.E.—The friends of this firm have been receiving a neat gift in the form of a vest pocket stamp case. A small card is enclosed giving prices, speed, &c., of "Union" shunt wound motors of from ¼ to 40 B.H.P.

MESSRS. WM. GEIPEL & CO., Vulcan Works, St. Thomas Street, S.E.—Leaflet illustrating and pricing their Vulcan thermo-electric pyrometers.

A very useful pocket memoranda book with calendar, and a number of pages of interesting matter concerning the "Thermit" welding system, has been received from MESSRS. THERMIT, LTD., of 27, Martin's Lane, Cannon Street, E.C.

THE PULSOMETER ENGINEERING CO., Ltd., of 61 and 63, Queen Victoria Street, E.C., are presenting their friends with a handy and serviceable diary for 1909—Letts's "Very Thin" Skeleton Diary—and a £1,000 Accident and Sickness Insurance coupon. The front cover has a space for holding season ticket.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton.—New price list (K) of arc lamps, particularising their shuntless single enclosed arc lamps, the patent "Magnet Juno" flame arcs, vertical carbon flame lamps, and magazine flame lamps, as well as their auto cut-outs and substitutional resistances, safety coils, economy coils, Bell arc lamps, raising and lowering gear, &c.

MESSRS. MATHER BROS., 36, Farringdon Street, E.C.—A neat but brightly printed wall-calendar has been received from this firm of electric lighting contractors. It has monthly sheets with the days in red, each sheet having also the other eleven months printed in blue.

MESSRS. E. BROOK, LTD., Colne Road, Huddersfield.—Monthly list (January) of E.B.H. single-phase motors held in stock by the firm.

MESSRS. GEO. MCCARTNEY & CO., of Cumnock, asks us to state that they have received so many inquiries for their "Orb" desk paper weight, of which we recently gave a notice, that a new supply has had to be put in hand. Requests still unfulfilled will be met as soon as possible.

MESSRS. C. A. VANDERVELL & CO., of Warple Way, Acton Vale, W., sent us one of their perpetual calendars with cards in the usual pocket, which is mounted on a card of extremely neat design. The firm have also forwarded us a copy of their 1909 illustrated catalogue containing prices and particulars of their various C.A.V. specialities comprising accumulators, ignition coils, electric driving and interior lighting lamps, magnetos, charging plants, switchboards, electric lighting sets, sparking plugs, and numerous other electrical accessories for motorists' use. The catalogue is finely produced and arranged, and contains capital illustrations, a number of them being views of the firm's works at Acton.

MESSRS. W. H. WILCOX & CO., LTD., of 23, Southwark Street, S.E., have sent us one of their date remembrancers for 1909 with monthly sheets, each of which is also a remembrancer of some of the engineers' tools and supplies of the firm.

The DAVIS ELECTRICAL CO., LTD., 17, Moor Street, W.—New abridged net price list (wholesale and export) of British-made cable, lampholders, cut-outs, switches, adaptors for metal-filament lamps, bell and telephone accessories, lamps and various supplies. The feature of the list is the working out of net prices, so that the contractor in getting out estimates can see at a glance the exact cost to him without working out various rates of discounts. *Bonâ-fide* contractors can obtain copies of the list on application.

The SUN ELECTRICAL CO., LTD., 118/120, Charing Cross Road, W.C.—New circular (No. 171) describing, illustrating and pricing, some new patterns of their "Sunlite" reflectors, with tantalum and Osram lamps, and several devices for the outside lighting of shop windows.

MESSRS. SIMPLEX CONDUITS, LTD., London and Birmingham.—This firm have issued a neatly produced 16-page pamphlet of pocket size, entitled "A Year's Progress" (a sequel to last year's brochure on "Ten Years of Simplex") giving a few particulars, with appropriate illustrations, of the work of the various departments of the business, followed by photographs of Mr. Waterhouse and leading members of the staff.

MESSRS. JULIUS SAX & CO., LTD., 100, Charing Cross Road, W.C.—New list (No. 101) of 10 pages giving particulars, illustrations from special photographs, and prices of Holophane reflectors, globes, reflector-bowls and two-piece spheres, these being the patterns best suited for electric lamps of various types, each of which is noted in the list with the globe details. A trade card sent to the above address will bring back a copy of the list.

BRITISH INSULATED AND HELSBY CABLES, LTD., Prescot.—New catalogue (No. L 33) just issued, wherein, in the course of some 56 pages, are given very fine illustrations (on art paper), with descriptive matter and diagrams, and in most cases prices also, of a variety of telegraph apparatus which is made by the firm at Liverpool, such

apparatus including polarised sounders and inkers, single and double current keys, sounder screens, galvanometers, retardation, condenser and resistance coils, condensers, Kamm's polarised relay, lightning arresters, Simplex repeater boards, central battery duplex, the Phantophone, multiple telegraph switchboards, and so forth.

Fire.—We are asked to say that the fire which recently occurred at the Antwerp Telephone and Electrical Works (W. F. Dennis & Co.) will not make any difference whatever in the prompt execution of either existing or new orders.

Meeting of Creditors.—S. S. Bojesen.—At the London Bankruptcy Court on Wednesday last week, the first meeting of creditors was held before Mr. E. Leadam Hough, Senior Official Receiver, under the failure of Sigurd Svend Bojësen, described as of 601, Salisbury House, London Wall. When before the Departmental Examiner, the debtor stated that 4½ years ago he formed the De Forest Wireless Telegraph Syndicate, Ltd., with a registered office at 6, Princes Street, E.C. He became managing director, without salary, but was allotted £15,000 in fully-paid shares. Eighteen months later the Amalgamated Radio-Telegraph Co., Ltd., was formed to take over the De Forest Syndicate and the Poulsen patents as going concerns. The registered office of the new company was at 601, Salisbury House, E.C. The debtor was appointed managing director at a salary of £2,000 a year, and his shares in the syndicate were exchanged for the same number of shares in the new company. A year ago he resigned the office of managing director, and some few weeks before his failure the company went into voluntary liquidation, with Messrs. Pixley & Allen as liquidators. Five months ago a company was formed to demonstrate the value of a new photographic process, under the title of the Kosmos Photographic, Ltd., with a registered office at Letchworth. The debtor entered into a contract to provide £1,500 capital for the purpose of carrying on the business; he found about £700, and became entitled to £700 shares of the company. The statement of affairs was not lodged, but the debtor roughly estimates his unsecured debts at £5,000 and his only asset is his interest under his mother's will, the value of which has yet to be ascertained. He attributes his failure entirely to the collapse of the Amalgamated Radio-Telegraph Co. The meeting was adjourned to enable a proposal to be submitted to the creditors.

Electrolene.—We have received a sample of "Meeco's Electrolene," a compound made by the Mechanical and Electrical Engineering Co., of 62, Bradford Street, Walsall, and successfully used, they say, for the past four years for preserving the commutators of dynamos and motors. It is a black, waxy substance, apparently embodying two chief constituents, judging by the colours of the fracture. Unfortunately we have no generating plant in this office, so that we cannot test its qualities.

Dissolutions and Liquidations.—Burmah Tramways Construction Co., Ltd.—At a meeting held on December 11th, it was resolved to wind up voluntarily, with Mr. W. R. Elston as liquidator.

Eldon Electric Co., Ltd.—A meeting of creditors is to be held at 24, Grainger Street West, Newcastle-on-Tyne, on January 11th. Mr. W. Sparks is liquidator.

Colliery Power Supply Syndicate, Ltd.—Creditors must send particulars of debts, &c., to the liquidator, Mr. W. W. Brierley, 24, Clegg Street, Oldham, by January 30th.

Forbes Patent Rail and Grip-Nut Syndicate, Ltd.—This company is winding up voluntarily, with Mr. P. Holman, 11, Queen Victoria Street, E.C., as liquidator.

Aluminium Corporation, Ltd.—Creditors must send particulars of their debts, &c., to Mr. L. W. Hawkins, Basildon House, E.C., one of the liquidators, by January 30th.

Reversible Turbine Co., Ltd.—A meeting will be held at 3, Great St. Helens, E.C., on February 9th, to hear an account of the winding up from the liquidator, Mr. J. D. Stewart Bogle.

British Electric Equipment Co., Ltd.—Notice is published of the release of the liquidator (Mr. H. de V. Brougham) from December 31st, 1903.

Canadian Trade.—Our contemporary, *Canada*, in to-morrow's issue, commences a series of articles on all points of interest in connection with British trade with Canada, the information being based on observations made by one who has personally covered the ground.

Exhibition at Nancy.—An international exhibition, under the patronage of the French Government, is to be held at Nancy from May to October, 1909. There will be sections devoted to mining, metallurgy, transport, decorative arts, electricity, textile and chemical industries, agriculture, horticulture, &c. Applications for space will be received by the Director-General of the Exhibition up to February 1st next. A copy of the programme and a plan of the exhibition may be seen by British manufacturers, &c., interested, on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patent Application.—Notice appears in the *London Gazette* for January 5th to the effect that the Société Anonyme du Temple has applied for the restoration of Patent No. 27,248, of June, 1904, for "Improvements in steam generators," which expired in June, 1908, owing to non-payment of renewal fee.

Bankruptcy Proceedings.—George Sutcliffe, electrical engineer, 23, Church Street, Abertillery.—The first meeting is to be held on January 13th, at Newport, and the public examination at Tredegar on February 3rd.

Trade Announcements.—Mr. E. Cordrey has resigned his position as manager to the Liverpool depôt of Pope's Electric Lamp Co., to take up a position with Messrs. Underwood (Manchester), Ltd. It has been arranged for the latter firm to act as wholesale selling agents for "Pope" lamps.

Messrs. E. P. Allam & Co. removed on January 1st to 28, Gray's Inn Road, W.C., where they have taken larger offices and showrooms. Their telephone number remains "Holborn 1280." The firm have also opened stores and a special department for electric motor repairs at 9, Church Passage, Chancery Lane, W.C.

The Chatteris Engineering Works Co. announce that Mr. A. W. Campbell, A.M.I.M.E., has been appointed their London representative.

Mr. T. A. Nunwick, of Ordsal Electrical Works, writes asking us to contradict a report that has been put in circulation amongst his customers to the effect that he was about to give up his agency for Lancashire, Yorkshire and Cheshire for Messrs. O. J. Thursfield & Co., electric fittings manufacturers, Birmingham. Mr. Nunwick's showrooms are still at 207, Deansgate, Manchester, to which address all inquiries should be forwarded.

Cromptonian Festivities.—On Saturday last, January 2nd, the Crompton Annual Christmas Trees, Tea and Entertainment—a very popular event of the year with the staff of the Arc Works and their families—took place at the Corn Exchange, Chelmsford, upwards of 1,000 guests, consisting of the wives and children of the members of the Arc Works Club being present, to be entertained by the generosity of the directors of Crompton & Co., Ltd. The Mayor and Mayoress of Chelmsford, Col. and Mrs. Crompton, Miss Crompton, Mr. and Mrs. Claud Crompton, and Mr. and Mrs. A. J. Hodgson, were among those present. The usual baby show was made an important feature—let us hope that among this year's 41 entries are some who will rise up to be the Crompton staff in prosperous years to come.

Electrical Progress in Italy.—The activity of electric development in Italy is illustrated at the moment not so much by large schemes as by a multiplicity of small undertakings, destined to bring the advantages of electric light and power to the smaller towns and townships. Thus, recent announcements show that prefectural sanction has been accorded to five schemes in the Milan district affecting so many as 16 localities; in the Cremona district, one of two schemes authorised affects 8 localities and the other 2; in the Turin district, three schemes will serve 6 localities; in the Novara district, a single scheme is aimed to supply numerous townships along the course of the River Sesia; in the Florence prefectural district, two schemes will serve 6 localities; 3 and 2 localities respectively are affected by two schemes sanctioned by the Brescia prefecture; and 4 and 1 by two schemes in the Coni district, while a similar number of localities are supplied respectively by two schemes sanctioned by the prefecture of Rome, in addition to the large scheme affecting the capital itself. Finally, the following prefectures have sanctioned one scheme each: Alessandria, Ancona, Ascoli Piceno, Coma, Naples, Plaisance, Pesaro-Urbino and Venice, affecting single localities in each case. Altogether 30 of these minor schemes have just been authorised, affecting over 60 localities. Although the majority of these schemes are small, yet in the aggregate they will create a large demand for machinery and material.

LIGHTING and POWER NOTES.

Berkhamsted.—The R.D.C. has decided to support the application of the Chesham E.L. Co. for a prov. order for E.L., thus falling into line with the U.D.C.

Canada.—Messrs. Mackenzie & Mann, who own the Winnipeg street lighting and tramway undertakings, have offered to sell them to the city at a valuation. The city has already spent some two million dollars on its own scheme, but is considering the offer.

Continental Notes.—Spain.—The Administration of the Canal de Isabel II has opened a "free competition" which will close on the 15th inst, for the reception of proposals or schemes best suited to utilise the electrical power which the Canal will furnish in three or four years from the central station which is to be established in the Calle de Santa Engracia, Madrid. The proposals or schemes are to be forwarded to the Canal offices, 3, Calle de Alarcon, Madrid, where further particulars are to be obtained. The contracts for the construction of the transverse canal have now been given out and the works taken in hand, and a beginning has also been made with the installation of the transmission line to Madrid and the building of the transformer station. The power available at the shafts of the turbines will be 6,000 H.P. When this project is completed, Madrid will possess four hydro-electric supply sources respectively, those of the Rivers Manzanares, Jucár, Tajo and Lozoya, yielding current equal to 25,000 or 30,000 H.P.—*Industria e Invenciones.*

Italy.—Offers have been made to the City Council of Rome by two important foreign firms to undertake the installation of the central station, for which the outlay, amounting to 17,000,000 lire, was voted in June last. These firms are prepared to carry out the installation at their own expense, being satisfied, should the municipal authorities be unable to raise the funds, with payments from

the results of the working, and with the liquidation of the capital at the dates indicated in the Council's financial scheme.

Eastbourne.—The T.C. has decided, upon the recommendation of the Electricity Committee relative to the 27 meters rented by the Eastbourne Pier Co., that for any consumer renting over 12 meters the charge shall be reduced from 10s. to 6s. per annum for each meter with the exception of double tariff meters.

Finchley.—The Council has decided to apply to the L.G.B. for sanction to borrow £2,200 for purchasing and erecting 50 arc lamps for public lighting.

Hucknall-under-Huthwaite.—The B. of T. has revoked the 1903 E.L. order.

Hull.—The Electricity Committee has under consideration a report by the T.C. in regard to the supply of energy to the Hessle U.D.C. The matter has been left over for consideration by a special meeting.

The B. of T. has informed the Hessle U.D.C. that it has deferred for a year the consideration of the question of revoking the electric light order.

Kinlochleven.—The British Aluminium Co. has now almost completed its big power scheme in Argyllshire. A large dam, supplied by an area of nine square miles, and holding 20,000,000 gallons of water, has been built 5½ miles from the head of Loch Leven. From the dam the water flows through a covered conduit 3½ miles in length, constructed of reinforced concrete, and thence, after passing through a penstock chamber, through 2,000 yards of pipe line. The power-house plant consists of nine Escher-Wyss turbines, of 3,200 B.H.P. There are 18 1,100-KW. generators, coupled in parallel, in pairs, to the large turbines, two 500-KW. machines for lighting, and two 75-KW. generators for traction. These were supplied by Messrs. Dick, Kerr & Co., who also provided two electric locomotives capable of hauling a load of 30 tons up a grade of 1 in 10 at ten miles per hour.

London.—HAMMERSMITH.—The Electricity Committee of the B.C. has had under consideration the question of the necessity of making further extensions to meet the increasing supply of electricity. The maximum demand upon the generating station has now reached 4,400 KW.; the total capacity of the plant is 5,000 KW. (without overload), and it is estimated that the supply to the Wolfram (Tungsten) Lamp Works, with the normal increase in the general supply, will next year bring the maximum demand to considerably over 5,000 KW. It is therefore obvious that more plant is now necessary in order to meet the statutory obligations so far as supplying new consumers is concerned. The engineer has reported that the extensions of machinery, plant, &c., necessary to meet the estimated increase in the normal requirements, and the estimated cost thereof, are as follows:—One turbo-generator, £7,500; condenser pipes and connections, £500; coal storage, No. 2 boiler house, £1,200; forced draught, Nos. 2, 3, 4 boilers, £1,200; ventilator and cooler, £450; mechanical stokers, £600; circulating pump at wharf, £600; feeders, Tungsten Lamp Works, £1,463: transformers, £1,000; house services (new consumers) £2,500; small L.T. mains extension, £750; rewinding No. 8 alternator for two-phase, £350; contingencies, £1,358; total, £19,471. The Committee approved the proposals of the electrical engineer.

WANDSWORTH.—The local Guardians have had under consideration the electric lighting of the infirmary, and the Works Committee is to obtain advice on the matter from the Battersea electrical engineer, if possible, otherwise, it is to expend not more than £21 in expert advice.

Northwood (Middlesex).—The Ruislip-Northwood Council had under consideration at its last meeting two schemes for street lighting. From preliminary estimates submitted by the Northwood Electric Light Co. and the Pinner Gas Co., it appeared that the Highways Committee reported that the cost of electric lighting would be £441 per annum, or under an alternative scheme £365, the price for gas being £419 per annum, or £348 under the alternative scheme. It was admitted that some of the calculations in the report were incorrect; the figures for electric lighting should be £380 per annum, or under the alternative scheme £317, while the price for gas would be £387 per annum, or under the alternative scheme £332. In the result the report was referred to a special Committee for consideration.

Orrell.—The B. of T. has revoked the 1903 E.L. order.

South Africa.—The borough electrical engineer at Durban is advocating the addition of low pressure turbines to the generating station plant, with a view to utilising the exhaust from the existing reciprocating plant.

Stoke on Trent.—The T.C. has decided to supply electricity to the free library, baths and museum, at a flat rate of 2d. per unit.

The L.G.B. has informed the T.C. that it is not satisfied as to the necessity for incurring an expenditure of £650 (for which a loan was applied for) at the present time, for the provision of a water cooling apparatus at the electricity and destructor works, and that it considered that the matter should be deferred pending the settlement of the federation question. The Council on December 31st decided to request the L.G.B. to reconsider the matter, as it was necessary that the plant should be installed.

Swindon.—The Education Committee has decided to have the Sanford Street school lit by electricity.

Watford.—At a meeting of electors on Monday night to consider the Bill for conferring further powers on the Urban District Council in relation to its water and electricity undertakings, Mr. Gowlett, on behalf of a number of electrical engineers in Watford, tendered their acknowledgment of the promise given them by the Committee of Watford Electricity Department that the powers referred to in Clause 36 would not be used. They considered that they would be in order if their protest were put on record at the meeting.

A committee has been appointed to watch the progress of the Watford U.D.C. Electricity Bill.

Wednesbury.—The Lighting Committee of the Corporation has intimated to the public that it is prepared to provide and fit the necessary wires on consumers' premises free of charge on the consumer guaranteeing to take and pay a minimum of 4s. per point per annum so wired for three years at least, the wiring to remain the property of the Corporation and all fittings and lamps required by the consumer to be affixed by him. The Committee is hopeful that this concession will induce intending consumers to adopt electric lighting, as the main objection to it—the provision of the wiring at the cost of the tenant—is now removed. The Committee also recommends an extension of the electricity mains in the town at a cost of £93.

Wigan.—A deputation of the Electric Light Committee, together with a deputation appointed by the Sanitary Committee, is to visit towns where modern destructors have been erected and worked in conjunction with electric light stations.

Wimbledon.—Metallic-filament electric lamps are to be substituted for carbon-filament lamps in the Town Hall, Queen's Road depôt, Sewerage Disposal Works, Isolation Hospital, Wandle Park House, &c. The borough electrical engineer has reported that the British Westinghouse Co. has practically completed the erection of the new high-tension main switchboard at the electricity works, and that he has successfully changed over to it from the old switchboard. In reference to the dispute between Messrs. Howden, whose tender for the supply and erection of a 1,000-KW. turbo-alternator had been accepted by the Council, and the borough engineer respecting the capacity of the alternator in question, the latter has visited the company's works and inspected the alternator, and is of the opinion that there is not the slightest doubt that the company will be able to comply with his specification. In view of this the Council is to inform the company that it will accept an alternator of 1,465 B.H.P., provided it complies in all respects with the specification of the electrical engineer. Sanction has been given for the borrowing by the Council of £6,000, the estimated amount of capital expenditure upon electric lighting mains for the year ending March 31st next.

York.—At a meeting of the T.C. on Monday, a letter was read from the Master Builders' Association protesting against the opening of a municipal showroom for the sale of electric fittings, on the ground that the principle was dangerous to all private enterprise. It was added that the members of the Association included the whole of the private electrical firms trading in the city, and that they took this opportunity of endeavouring to prevent a pernicious principle being introduced to undertake the sale and fixing of fittings (invariably at an inadequate and cut rate), was unfair to the private traders who were ratepayers, and could only result in their being compelled to close their establishments. The Council decided by 22 to 14 to proceed with the showroom scheme.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramways department had a hard time on December 28th and 29th last, when snow fell almost incessantly, to a depth of some 3 ft. with drifts of much greater depth. The tramway staff, 250 in number, under Mr. R. S. Pilcher, the manager, with some 650 extra men, were engaged in clearing the tracks of snow, the snow ploughs having proved useless for this work. Three routes were cleared by the afternoon of the 28th, and by continuously running the snow ploughs all night, two out of the seven routes were kept open. It was not until midday, on the 30th, that all the routes were again open for traffic. Some 300 tons of salt were used on the track, and so far little damage to the car equipment has been found. Precautions were, however, taken on the outbreak of the storm—all the under cables being painted with thick P.B. paint and the motors made watertight. The suburban car service, which has running powers over the Corporation lines and operates some four miles of country track, was entirely blocked for three days. The Corporation equipment includes three cars fitted with steel snow ploughs having side wings capable of clearing 9 ft. beyond the tramway track, also three salt cars fitted with salt hoppers. The tramways department will lose over £1,000 in traffic receipts and expenses through the storm.

Belfast.—At a monthly meeting of the Corporation, held on New Year's Day, it was announced that the arbitrator between the Corporation and Messrs. J. G. White & Co., of London, in respect of the tramway engines, had awarded the Corporation the sum of £1,700. In the case of the other engines supplied by an English firm, it was found that part of the work had been done in Germany, and as the contract had not been completed in time, the

matter has been referred to arbitration. Nothing was done in connection with the Whitewell and Cavehill tramway, nor in connection with the proposed tramway between Belfast and Holywood.

Bournemouth.—The Corporation has considered a lengthy report from Mr. J. B. Hamilton, general manager of the Leeds City Tramways, on the organisation, financial position, &c., of the local tramways. Mr. Hamilton advices the allotting of cars to each depôt, and a foreman for overhauling, holding the latter responsible for the general condition of these cars. He suggests that the organisation should be remodelled, and that a general manager should be appointed at a salary of £600 a year; an electrical engineer at £200 a year; and a rolling stock superintendent and a traffic superintendent at £175 a year each. This scheme would result in the saving of £325 a year. The running of Sunday cars is advocated, and a clear profit of from £4,000 to £5,000 per annum is suggested from this source. If all the recommendations are put into force he estimates a saving of about £4,000 per annum.

Brazil.—The General Electric Co. (Schenectady) has secured a contract for the electrification of the Central Railway of Brazil, in the neighbourhood of Rio de Janeiro, an important Government enterprise. The system embraces 700 miles of track, 303 locomotives and about 3,000 cars. The company's contract will entitle it to sell light and power in Rio de Janeiro and Nichtheroy. The company's agents have also been granted a concession covering the supply of light and power to the city of Sao Paulo.—*India-Rubber World.*

Burnley.—The Tramways Committee has recommended the formation of a special reserve to cover "third party" claims, and proposes to make a contribution of £600, for the first year, to it.

Continental Notes.—Roumania.—According to the Bucharest Press, a number of electric tramways are in contemplation for the chief towns of Roumania. For the purpose of providing them a company is being formed, with a capital of 15,000,000 fr., in which capital the local municipalities will take part to the extent of 5,000,000 fr.

Belgium.—The Pipe Co., of Brussels, has just supplied a 28-h.p. motor vehicle with expanding ladder for use in connection with the up-keep of the overhead conductors of the electric tramways in Brussels.

Italy.—The Italian Ministry of Public Works has granted to the Briantee Electric Tramways Co., Ltd., a concession for the construction and working of a line of tramway from Monza to Meda (Milan). He has also approved the form of the concession for a new line of tramway from Lodi to Piacenza, as definitely drawn up by the joint representatives of the Provinces of Milan and Piacenza, and the Municipalities of Codogno, Castelpusterlengo and Piacenza.

Germany.—From statements made at the second ordinary general meeting of the Ahrweiler Railless Electric Co., Ltd., it appeared that the new system had worked satisfactorily and punctually, and only quite unavoidable working mishaps had occurred. The number of passengers had steadily increased, and the prospect of a sound development of the undertaking could be seen ahead.—*Zeitschrift für Elektrotechnic.*

Wald.—Arrangements are being made for a secondary railway from Kaan, *vid* Wald, to Maugenberg, with a branch to the Solingen narrow-gauge line.

The rebuilding of the Halle a-d-Saale line from Geisa to Tann has been given to Carl Brandl, Halle, at £11,418.

Devonport.—Mr. J. C. Tozer presided over a special meeting of the Tramway Committee, held on Monday, to consider the letter received a short time ago from the Devonport and District Tramway Co. announcing its intention of discontinuing running on the leased lines after January 16th. The town clerk (Mr. R. J. Fittall) advised the Committee upon the legal position, and he was instructed to serve notice upon the company requiring it to provide a reasonable service in the public interest on the lines leased by the Corporation to the company on and after the 17th inst., in accordance with the terms of the lease, and, in case the company raised any question, to apply to the B. of T. to determine the matter.

Doncaster.—At a recent meeting of the T.C., Mr. Wortley proposed that the whole of the tramway routes should be worked in ½d. stages from February 1st next. He argued that the present annual deficiency of £2,000 would be reduced by popularising short-distance travelling; the Council, however, rejected the proposal.

Dundee.—From a return prepared by Mr. Peter Fisher, the manager, it appears that the tramways have had a record year. For the 12 months ended December the mileage run was 1,334,003, and 16,553,057 passengers were carried. The receipts were £61,514. When comparison is made with English tramway centres the receipts seem to be small in relation to the number of passengers carried, but this is due, says the manager, to the low average fare prevailing in Dundee.

Answering criticisms as to the number of passengers using the new section, Mr. Fisher, the manager, said 1,500 people used the cars on the new route, and he was hopeful that it would yet prove a paying part of the system.

Folkestone.—The Council has decided to instruct the town clerk to take the necessary steps to oppose the new Bill of the Folkestone, Sandgate and Hythe Tramways Co., which seeks to avoid laying the surface-contact system in those towns, as agreed in the previous powers.

Glasgow.—At its next meeting the T.C. is to consider a proposal that the Parliamentary Committee shall report on the assessment of underground mains, pipes, &c., in the city, and as to whether the law shall be altered. In Glasgow the assessment of pipes and underground works of the Corporation is one-fourth of the annual valuation, as against the full annual valuation in adjoining areas. If the latter valuation were adopted, the city departments would pay some £35,000 per annum, representing 2d. in the £.

Hull.—The Corporation has decided to join with the Doncaster Corporation in ordering some 350 tons of rails from a Belgian firm. It appears that English firms refused to consider an order for less than 500 tons, and would not go to the trouble of rolling 60-ft. lengths, as required.

Rowley Regis.—At the monthly meeting of this U.D.C. last week, it was announced that in all probability there would be constructed in the near future a tramway between Oldbury and Beachheath. This will be the means of connecting Cradley Heath, Old Hill, Rowley, Whiteheath, Oldbury and West Bromwich. It is stated that Oldbury District Council will be responsible for the new line. At the same meeting a fear was expressed that there would be some further delay in the construction of the Cradley Heath, Quarry Bank and Brierley Hill light railway, owing to the negotiations between the promoters and authorities not having been completed.

Willesden.—The secretary of the Metropolitan Electric Tramways, Ltd., has written stating that the suggestion made by the Council as to the linking up of the systems of the L.C.C. and the company at Scrubbs Lane and Harrow Road cannot be adopted at present, but the proposal will not be overlooked.

TELEGRAPH and TELEPHONE NOTES.

Leeward Islands.—The colonial report for the year 1907-8 states that the subsidies paid to the West India and Panama Telegraph Co. amount to £1,400 per annum, of which Antiqua pays £500, St. Kitts Nevis £500 and Domioica £400. In Antiqua there are 168 telephone instruments and 350 miles of wire; in St. Kitts there are 97 instruments and 256 miles of wire, and in Dominica there are 105 instruments and 400 miles of wire. Revenue in Antiqua amounted to £828 and expenditure to £781, while the figures for St. Kitts were £444 and £663, and for Dominica £458 and £648 respectively. A similar report for Grenada states that the telephone service was satisfactorily maintained throughout the year.

Manchester.—Correspondence has passed between the Manchester Corporation and the Postmaster-General with reference to an application for permission to erect posts and carry overhead telegraph wires along certain thoroughfares in the city. The application was referred to a Committee, which reported almost unanimously against it. The Postmaster-General has given notice that, in the event of consent being withheld, the difference will be referred to the Stipendiary Magistrate, under the Telegraph Act.

New Telegraph Facilities.—According to the *Zeitschrift für Schwachstromtechnik* Munich and Trieste will soon be connected by a direct telegraph line, this being rendered necessary by the opening of the railway at Tauern, as the neighbouring country will rapidly develop traffic between Southern Germany and Trieste.

The German Imperial Post Office has opened a telegraph station to international traffic at Grootfontein in German South-West Africa, situated about 90 km. from Otawi. The Great Northern Telegraph Co. announces that the Chinese Government has opened telegraph offices at Luhfeng and Tengyun in the Province of Kwangsi.

Wireless Telegraphy.—A new Marconi wireless telegraph station is in course of erection at Clifden, County Galway.

For some time past negotiations have been in progress with the Marconi Wireless Telegraph Co. and the shipping companies for obtaining meteorological reports by wireless telegraphy from liners crossing the Atlantic. The necessary instructions as to observing and coding have now been issued, and the shipping companies have been asked to allow their officers to report observations to the Meteorological Office upon the forthcoming passages.

Marconi wireless telegraph apparatus has been installed on board the *Prinz Friedrich Wilhelm*, and the Telefunken system on the *Admiral Von Tirpitz*, the latter installation being for experiment only.

Preparations are in progress, says the *Times*, for the establishment of a wireless telegraph station at the Claypit Lane (Leeds) Barracks of the Northern Command Telegraph Companies (Royal Engineers), and it is stated that this station will be the first of its kind in connection with the Territorial Army.

(*Continued on page* 63.)

THE POST OFFICE RADIO-TELEGRAPH STATION AT BOLT HEAD.

This station, although the seventh radio-telegraph station belonging to the British Post Office, is the first one to be opened to the public for communication with ships at sea. It is situated in South Devon, about 5 miles south of Kingsbridge, and is some 400 ft. above sea level. Its

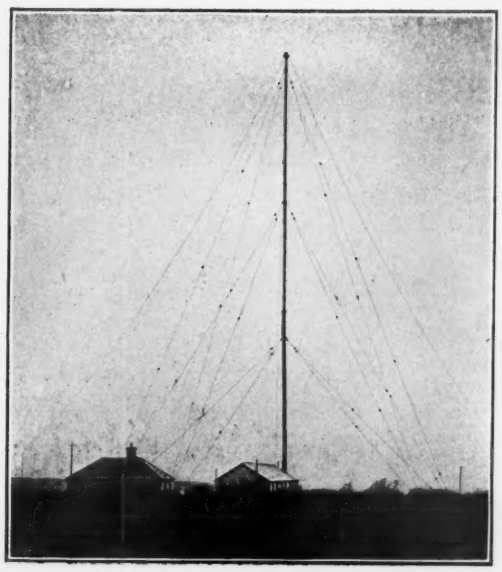


Fig. 1.—View of the Mast with Aerial Wires.

normal range of communication is 250 miles, but good communication is daily obtained with Scheveningen, in Holland, some 350 miles distant.

The construction and equipment of the station was carried out according to the specifications of the Engineer-in-chief to the Post Office (Major O'Meara, C.M.G.), who placed contracts

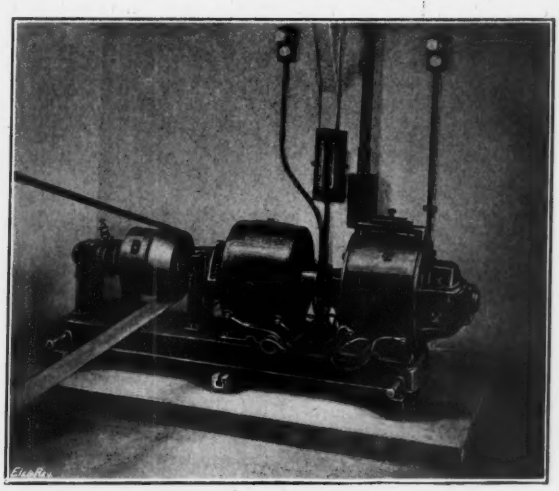


Fig. 2.—3-kw. Motor-Generator for Supplying the Aerial, Battery Charging, &c.

with the Marconi Wireless Telegraph Co. and the Westminster Engineering Co., the former for the supply of mast, aerial, &c., and the radio-telegraphic apparatus, while the latter supplied the power plant, which includes an oil engine, dynamo, secondary battery, switchboard, and the lighting of the building.

The work, which included the erection of a single-storied brick building to accommodate the power plant and the telegraphic apparatus, was commenced on July 15th, and the station was examined and tested by Mr. J. E. Taylor, of Major O'Meara's staff, a few days before the official opening by the Postmaster-General on December 11th last.

Mast Aerial, &c.—The mast (fig. 1) is built of Oregon pine, and is in three sections; the lower mast being 73 ft. in length, the topmast 56 ft., and the top-gallant mast 54 ft., which, with the reduction for the overlap of the housing portions, provides a total height of 161 ft.

There are three sets of four flexible galvanised iron wire rope stays, each stay being divided into sections by porcelain insulators. The lower stays are 3 in. in circumference, are divided into two sections, and are insulated at three points; the intermediate stays are 2½ in. in circumference, are divided into three sections, and are insulated at four points; the upper set of stays are 2 in. in circumference, are divided into four sections and are insulated at five

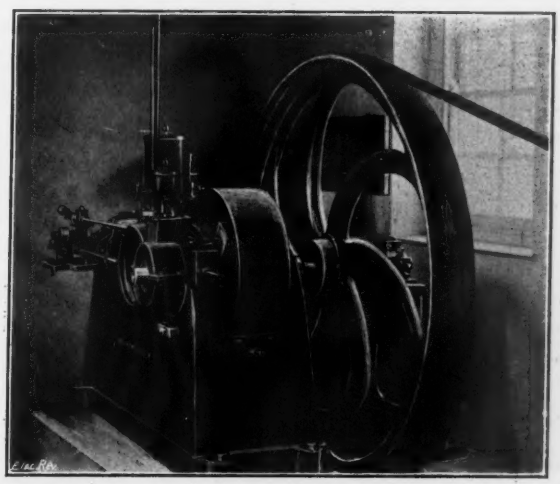


Fig. 3.—Showing the 10-b.h.p. Oil Engine for Providing Power.

points. The separating insulators which are shown in our view are arranged to be in compression, so that if, for any reason, one of them should break, the stay would not part. Means are provided for regulating the tension in each stay.

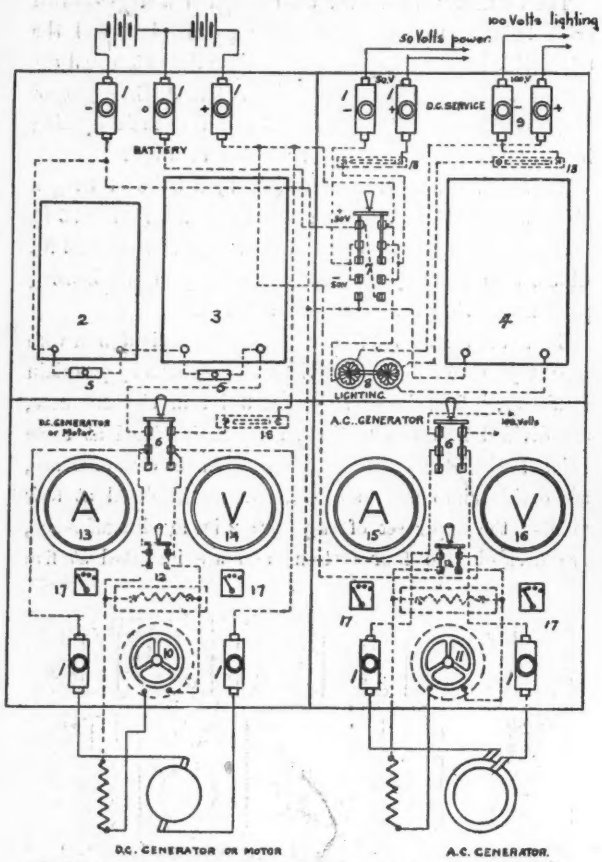
Four short poles about 30 ft. in height are set some 150 ft. distant from, and form the corners of, a rectangle around the mast, for the purpose of anchoring the aerial wires.

The aerial consists of two stranded phosphor-bronze conductors connected together at the operating room, but carried upward separately, one on each side of the mast. At the top, where they are attached to ebonite rod insulators, both conductors are bifurcated and all four portions are then extended radially in a downward direction to within 50 ft. of the four 30-ft. poles already mentioned, to which they are attached by ebonite rod insulators and rope stays.

The "earth" connection is made by means of 52 copper

leads, joined to 26 galvanised iron plates, 5 ft. by 2½ ft. in area, connected together and placed vertically in the ground, and forming a portion of a circle around the operating room.

For protection against damage by lightning, a sliding ebonite rod passing through the wall of the instrument



1, Cut-out, 30-amp., in C.I. case; 2, Reverse-current circuit-breaker, 50-amp.; 3, Motor starter, 5 H.P.; 4, Regulating resistance on lighting circuit; 5, Short-circuiting plug; 6, D.P. switch, 30 amps.; 7, D.P.T.O. switch, 30 amps.; 8, D.P. switch, 7 amps.; 9, Cut-outs, 10 amps.; 10, D.C. generator field regulator; 11, A.C. generator field regulator; 12, Field switches, 6 amps., with carbon breaks, non-inductive resistance; 13, D.C. ammeter; 14, D.C. voltmeter; 15, A.C. ammeter; 16, A.C. voltmeter; 17, Meter switches.

Fig. 4.—Switchboard Connections.

room enables the operator to directly earth the aerial outside the building by bringing the wires against a brass ring connected to the earth plates.

The Power Plant.—A Campbell oil engine (fig. 3) capable of developing a maximum of 10 B.H.P. when running at a speed of 265 R.P.M., is utilised to drive through a belt and friction clutch a 3-KW. direct-current dynamo, coupled direct to an alternator. The clutch is required in order to avoid the removal of the belt when the engine is not in use, and the dynamo is being run as a motor from the secondary cells; it also provides an easy means of starting the engine.

The D.C. dynamo (fig. 2) provides current for charging the 52 secondary cells, for exciting the field of the alternator, and for lighting the building. It is also run as a motor from the secondary cells to drive the alternator when the engine is not in use.

The alternator furnishes 3 KW. at 100 volts, at a frequency of 50.

The various connections are taken to a switchboard placed in the instrument room within easy reach of the operator, so that he can manipulate the different switches practically without leaving his seat at the operating table. A full diagram of the connections of the switchboard is shown in fig. 4.

The Radio-Telegraphic Apparatus.—The chief connections of the radio-telegraphic apparatus are indicated in fig. 6. The alternating current, controlled by means of a Morse key, is passed through a 3-KW. transformer, placed in oil. In circuit with, and forming a shunt to the contacts of the Morse key, are four "magnetic keys" joined in parallel, which open when the alternating current is passing through its zero value, thereby preventing any injurious sparking at the key contacts, and ensuring a rapid break in the current.

A means of regulating the power used is provided by an iron core adjustable inductance A.

The secondary of the transformer is connected through iron-core choke coils B, and air-core choke coils C, to the battery of condensers D. These condensers are made up of

Fig. 5.—View of Station, Bolt Head.

thin iron plates separated by sheets of glass and immersed in oil. One side of each of the condensers is connected to the spark-gap E, which is enclosed in a wooden box, while the other sides of the condensers are connected together and through the inductance F and primary G of the oscillation transformer to the other side of the spark-gap.

The secondary H of the oscillation transformer is connected on one side to the aerial, and on the other to the earth plates through a small spark-gap. This small gap is for the purpose of insulating the aerial in regard to received signals, whilst, as regards transmission, the spark makes the gap practically a direct earth connection.

Means are provided for varying the position of the secondary coil of the oscillation transformer in relation to the primary coil, in order to vary the strength of coupling and thereby to obtain sharper resonance.

The wave length of the transmitted signals is 600 metres, but as it may be necessary to signal with a wave length of 300 metres, a second set of condensers J, spark-gap K, tuning inductance L, and oscillation transformer M is provided. Both transformers are fitted with plug connections, so that the "aerial" and "earth" leads may be readily transferred from one to the other.

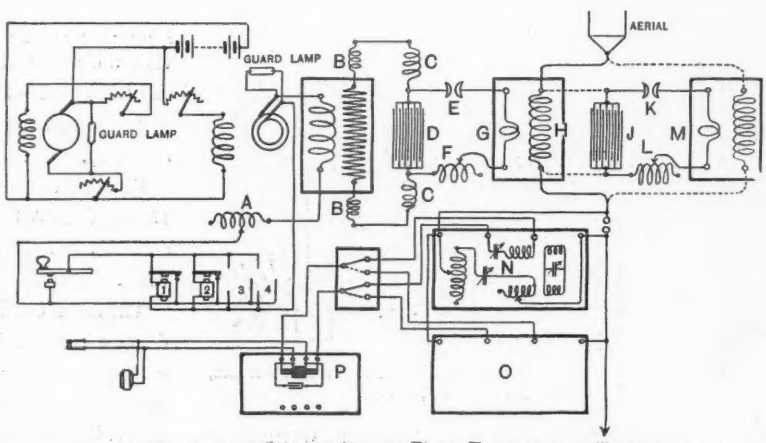


Fig. 6.—Diagram of Connections of Radio-Telegraphic Apparatus.

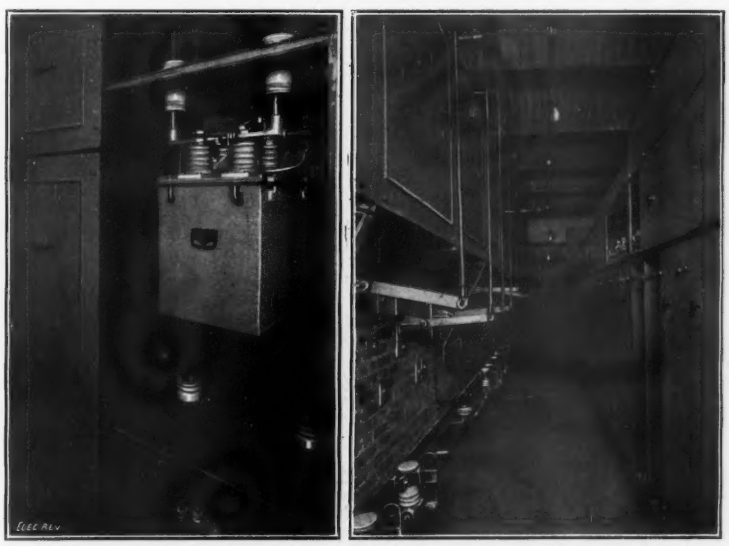
With the shorter wave length, the oscillations from the 600-metre transformer charge the second set of condensers,

which discharge through the second spark-gap and the second oscillation transformer, to which the "aerial" and "earth" would in this case be connected.

The receiving apparatus is permanently connected to the transformer side of the small gap, which, as already stated, gives perfect insulation for reception purposes, and yet is practically a direct earth connection when sparks are passing. This arrangement would, however, give a loud click in the telephone whenever a spark passed, hence the Morse key is fitted with two small contacts normally separated, but which make connection and thereby short-circuit the telephone as the key is being depressed, and separate again after the sparking has ceased. Immediately these contacts open, any incoming signals pass through the receiving apparatus and actuate the telephone. Hence it is possible for the operator to be stopped in the middle of transmission if it should be necessary.

Received signals pass down the aerial through the secondary of whichever oscillation transformer is in use, to "earth" *viâ* one or other of the two multiple tuners, N or O, which are a series of adjustable inductances and capacities arranged for wave-lengths of 100 to 2,000 metres in one case, and for 2,000 to 6,000 metres in the other.

The New H.T. Switchboard, Hammersmith Electricity Station (see page 62).



Views of the Cell Construction, Oil Switch, &c., Hammersmith Switchgear (page 62).

Each tuner is provided with a switch, which connects the leads of the magnetic detector P to the "stand-by" or "tuning" positions. In the former position the coil of the detector is directly in circuit with the aerial tuning inductance, and in the latter position there is a double transformation between the aerial and the detector. The coupling of this double transformation can be varied by turning a handle at the side of the instrument. By this means it is possible to cut out to some extent the signals of another station which may be causing interference.

The magnetic detector is the well-known Marconi type of instrument, and is connected to a switch, which joins it to either tuner as desired. The headgear telephone receiver is connected to the detector in the usual way, and is also connected to the two additional contacts on the Morse key.

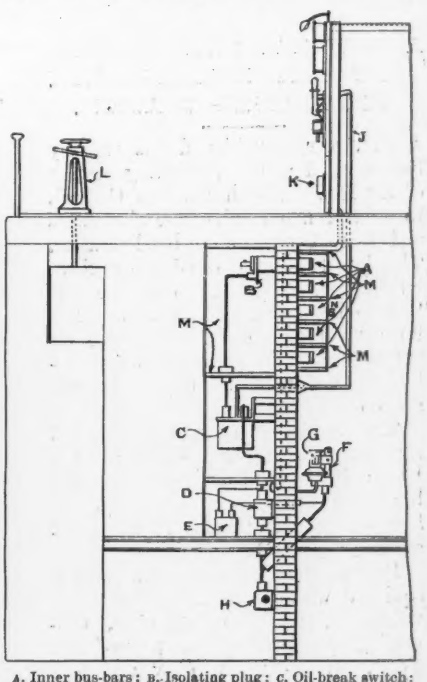
The coherer and Morse receiving apparatus are not used, as the station is always open and an operator is listening continuously when not transmitting.

The building, fig. 5 (page 60), is 55 ft. long, 13 ft. broad, and 14 ft. high, and is divided into five rooms, as follows:—

Instrument room, 11 ft. × 7½ ft.
High-tension room, 13 ft. × 6½ ft.
Battery room, 13 ft. × 6½ ft.
Engine room, 24 ft. × 12 ft.
Ante-room, 11 ft. × 5 ft.

Messages are passed direct to Exeter by an overland telegraph wire.

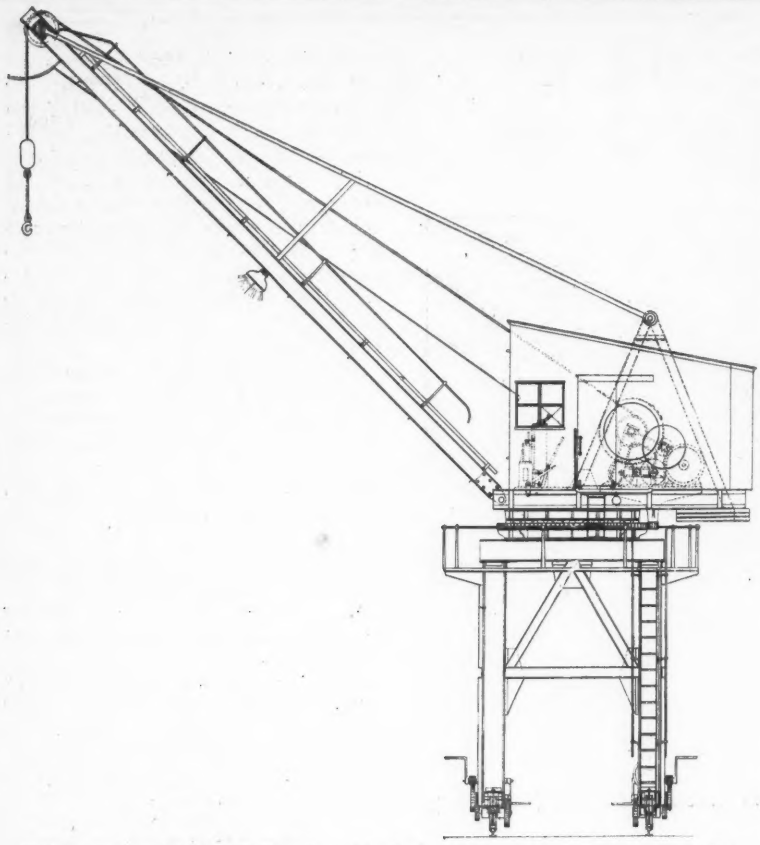
The photographs have been kindly lent by Mr. Coxon (of Major O'Meara's staff) who supervised the installation of the power plant at the station.



A, Inner bus-bars; B, Isolating plug; C, Oil-break switch; D, Current transformer; E, Potential transformer; F, Isolating switch; G, Outer bus-bar; H, Dividing box; J, Oil switch lever; K, Reverse relay; L, Shunt regulator; M, Fireproof divisions; N, Iron doors.

Sectional Diagram showing Arrangement of New Switchgear, Hammersmith (page 62).

Derby Electric Lighting. — The T.C. has applied for a loan of £300 for a water softener at the power station.



Hoisting speeds:—Height of lift, 20 metres; 4-ton load at 37·25 metres per minute; 2-ton load at 74·5 metres per minute; motor, 45 B.H.P., at 587 R.P.M. Slewing speed, with 4-ton load, 108 metres per minute; motor, 6 B.H.P., at 965 R.P.M. Three-phase current, 50 periods and 225 volts pressure.

STOTHERT & PITT ELECTRICAL CRANE FOR THE ARGENTINE.

A NEW H.T. SWITCHBOARD AT THE HAMMERSMITH GENERATING STATION.

A NEW H.T. switchboard has recently been erected at the generating station of the Hammersmith Borough Council, to control five single-phase alternators and four two-phase turbo-alternators. The board is also fitted with three interconnecting panels to enable the load to be placed on any of the five inner bus-bars. Each single-phase set is fitted with selector switches for connecting the machines to any of the above bus-bars.

The board is of the mechanical remote-control type, having all the H.T. switchgear placed in a chamber beneath the switchboard gallery, the arrangement being shown in views and section on page 61.

Each single-phase alternator panel is equipped with an ammeter, integrating wattmeter, rotary synchroniser, connecting plug, voltmeter, power-factor meter, reverse-current relay and four special oil-switch operating levers operated by one trip coil. These operating levers are of special design, and so arranged that only one switch can be closed at a time; the levers are fitted with one removable handle per panel, this handle, when placed in the operating lever, closes a synchronising circuit and operates the switch. Should the handle be removed the switch automatically trips, and it is impossible to work any of the levers without the handle.

All the H.T. gear is placed in separate cubicles, each of which is subdivided into three compartments by means of fireproof divisions. The top compartment is fitted with the necessary isolating plugs; the centre one with the four single-pole oil switches, and the bottom one contains all the instrument transformers.

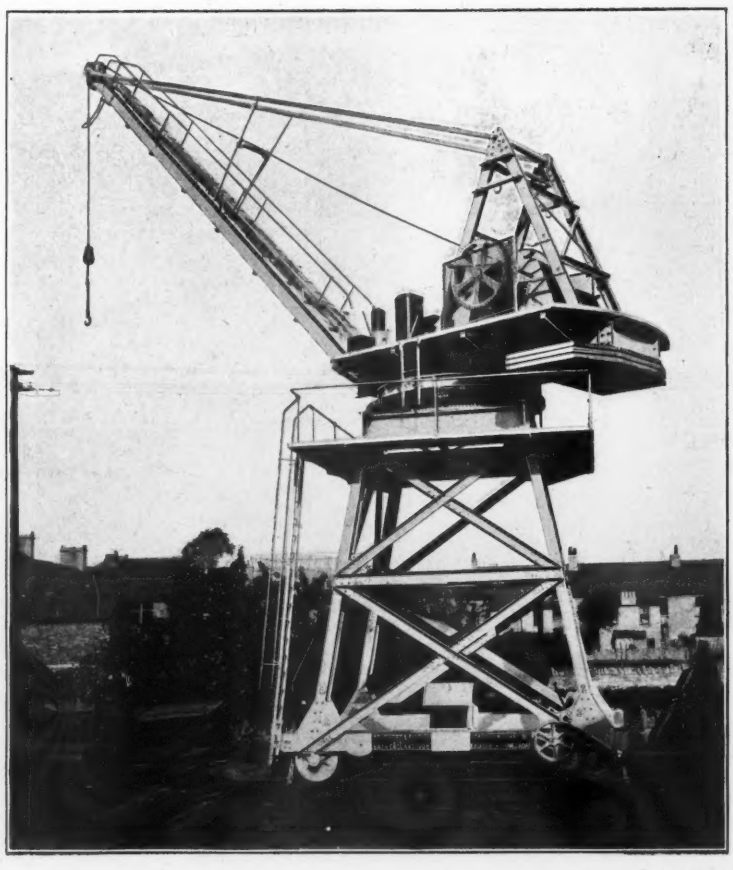
The two-phase panels are similar to the single-phase panels, with the exception that no selector switches are provided.

Our views show the general appearance of the switchboard, the cubicle work, and one of them shows a two-phase cubicle with the iron door removed, exposing the oil switch, &c.

The work has been carried out by Messrs. Spagnoletti, Ltd., of London, W.

A LARGE ELECTRIC CRANE EQUIPMENT FOR THE ARGENTINE.

No fewer than 24 electric cranes for installation at Riachuelo, Buenos Ayres, were recently shipped from this country by Messrs. Stothert and Pitt, to the order of the Argentine Government. These cranes are each capable of lifting 4 tons at a fixed radius of 10·50 m., with the centre of the jib head pulley 15 m. above the rail level. The cranes are each



ELECTRICAL CRANE EQUIPMENT FOR THE ARGENTINE.

mounted on a truck of the gantry type, running on rails set to a gauge of 3 m. centres, and they have each two motors, one for lifting and the other for slewing. The following are the speeds: — Lifting, 4 tons at 37·25 m. per min., or 2 tons at 74·50 m. per min.; slewing, 4 tons at 108 m. per min. at the hook.

The lifting gear is of double purchase, fitted with two speeds; the lifting is arranged on Stothert and Pitt's patent "free barrel" system, the rope barrel running loose on the shaft, and coupled through a coil clutch. The latter is so connected, under the Aldridge-Stothert patent, that the motion which gives current to the motor also engages the coil clutch. The foot lever is interlocked, under the Stothert-Evans patent, with the controller handle, so that it is impossible to work one against the other.

The advantage of the "free barrel" system lies in the fact that the load can be lifted to any desired height and released immediately under the control of the foot brake, without having first to bring the armature and its train of gearing to rest, thus giving a longer life to the motor, which, running in one direction only, is not subjected to any sudden shocks.

"Pitt's" patent over-winding gear is provided and fitted with overload and no-voltage release, which arrangement releases a spring and automatically puts on the brake and throws the controller handle to the "off" position. Slewing is operated from the motor by means of a train of gearing, working into an externally-toothed fixed slewing ring.

The weight of the revolving superstructure is carried on a live ring of steel rollers, bearing on top and bottom roller paths of cast-steel. A powerful mechanical brake is fitted to this motion, and the first reduction runs in an oil bath. The travelling motion is operated by hand power, two of the travelling wheels being driven by means of a train of spur gearing. The superstructure consists of two steel angle main girders, with structural "A" frames for taking the anchored ends of the tie rods. The lifting and slewing gears are self-contained, and are carried on a bedplate casting resting on the main girders, while suitable girders and stretchers are provided for taking the centre pin, &c.

The superstructure and truck are of steel sections, and the latter has a clear archway, 2·85 m. high, being mounted on four double-flanged wheels set to a gauge of 3 m. centres and placed at 4·10 m. centres.

The motors are three-phase, at 225 volts and 50 periods. The lifting motor gives 45 B.H.P. at about 587 R.P.M., and runs in one direction only, while the slewing motor is of 6 B.H.P., 965 R.P.M., and is reversible. Each motor is governed by a separate controller, the handle of the lifting controller being connected with the coil clutch as previously described.

A switchboard is fitted and has main switch and fuses, voltmeter, ammeter and connections for lighting.

A fixed light is provided in the cabin, and there is a portable light to enable all parts of the gear to be examined, whilst a five-light cargo light is located on the jib.

The crane has a cable drum with 30 m. of flexible cable and unions adapted to the contacts, and the energy is conveyed to the switchboard by ring collectors on the centre pin. The machinery and driver's platform on each crane are protected by a house constructed of teak and carried on a steel framework.

TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 58.)

Spain.—The Government has granted to the provincial authorities of Guipuzcoa a concession for the establishment and working during 35 years of an interurban telephone system, to link up the outlying districts of the above-mentioned province. For this concession the province will contribute to the State 10 per cent. of the gross receipts.

Telegraphic Interruptions:—

Port Arthur-Chifu	... March 9, 1904
Pontianak-Saigon	... Sept. 16, 1908
Medan-Penang	... Dec. 22, 1908
Malta-Zante	... Dec. 29, 1908

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—Sydney, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236. Specification may be seen at the Electrical Review Office. Also see our "Official Notices" December 18th.

Sydney.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" December 11th.

Sydney.—March 1st. Two 1,000-kw. and two 600-kw. motor-generators with starting and regulating apparatus for the Municipal Council. See "Official Notices" January 1st.

Beckenham.—January 18th. Electric wiring of houses in the U.D.C.'s district. See "Official Notices" to-day.

Belgium.—Brussels.—February 8th. The Compagnie de l'Exposition de Bruxelles, No. 34, Rue des Douze-Apôtres, requires tenders for laying down and working electric tramways within the precincts of the forthcoming Exhibition.

Birmingham.—January 14th. Telephone installation at the workhouse in Western Road, for the Guardians, where specifications can be obtained.

Dundee.—The T.C. invites tenders for the supply of uniforms for the tramway men. Apply to Mr. Peter Fisher, Manager.

Fareham.—January 20th. Three alternators and exciters, high and low-pressure switchboards, and overhead travelling crane, for the Council. See "Official Notices" December 18th.

Germany.—January 26th. The Finance Deputation of Hamburg is inviting tenders for the supply and erection of 43 electrical cranes on the quays.

Tenders are about to be invited by the municipal authorities of Oschatz, Saxony, for the establishment of a central electric lighting station in the town, at an estimated cost of £13,500.

Grimsby.—January 16th. D.C. motors and starting panels (sizes ½ to 15 H.P.) for the Corporation. See "Official Notices" January 1st.

Halifax.—January 20th. Stores and materials for the Council's tramways and electricity departments. See "Official Notices" to-day.

Hammersmith.—January 27th. One 2,000-kw. steam turbine generating set with condenser for the B.C. See "Official Notices" to-day.

Italy.—Rome.—February 8th. Tenders are required for the lighting of the Palais de Justice, including fittings. Inquiry must be made, through local agent, at the chief engineer's office for the General Service of Rome, Department of Public Instruction.

Rome.—The Administration of the Italian Government Railways will shortly require 500,000 arc lamp carbons of various sizes.

Plymouth.—January 30th. Stores for the Corporation electricity department. See "Official Notices" to-day.

West Ham.—January 21st. Electrical and other supplies for the Council. See "Official Notices" January 1st.

CLOSED.

Belgium.—Three tenders were submitted to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the overhead electric equipment, and the fixing of the electric connections to the rails, on the new line between La Louvière and Binche. The lowest offer (£3,240) was that of the Société de l'Electricité Industrielle, of Liége. La Compagnie Générale d'Electricité, of Paris, quoted £3,280, and La Compagnie Belge d'Electricité Siemens-Schuckert, of Brussels, £4,483.

Australia.—MELBOURNE.—Postmaster-General :—

W. T. Henley's Telegraph Works, Ltd.—Three miles vulcanised, india-rubber-insulated, taped, lead-covered, served, armoured, braided and compounded cable, £73 per mile.

Melbourne City Council Electric Supply Committee :—

Reason Manufacturing Co.—250 electricity recording meters, £325 f.o.b. London.
Siemens Bros. Dynamo Works.—350 ditto, £994 15s. f.o.b. London.
Allgemeine Elektricitäts Gesellschaft.—170 ditto, £233 15s. f.o.b, Hamburg.
Australian General Electric Co.—125 indicators, £130 7s. 6d.
Reason Manufacturing Co.—32 ditto, £62 16s. f.o.b. London.
Babcock & Wilcox, Ltd.—100 spare boiler tubes, £1 10s. each.

BRISBANE.—Postmaster-General :—

Western Electric Co.—Common battery switchboard, £279 10s. (Apparatus required for 220-volt pressure, in place of the 110-volt formally contracted for.)

VICTORIA.—Commonwealth Postmaster-General :—

British Insulated & Helsby Cables, Ltd.—2,500 two-conductor cords, 11½d. (£117 8s. 9d.); 400 ditto, three-conductor, 6 ft. 9 in., 2s.; 1,000 ditto, two-conductor, 8 ft., 1s. 6d., and various battery material.
India-Rubber, Gutta-Percha & Telegraph Works Co.—6,000 Leclanché cells, 8½d. each; 15 differential galvanometers, £2 15s. 5d. each; 25 ampere-meters, 16s. 10d. each; 200 8-in. trembling bells, 4s. 4d. each; 50 5-in. ditto, 11s. each; and various battery instruments.

Hanley.—The T.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., for cables, and that of the British Electrical Trades Supply & Bitumen Co. for bitumen.

Hull.—The Corporation Tramways Committee on Friday accepted the following tenders :—

Paterson Engineering Co.—Oil eliminator, £225.
G. Jackson & Sons, Witham.—Engine and condensing plant, £667.
Staveley Coal & Iron Co., Chesterfield.—36-in. cast-iron pipes for condensing water, £744.
United Electric Car Co.—Six car-bodies, £1,800.
Mountain & Gibson, Ltd.—20 trucks for cars, £43 each.
Raworth & Co.—Regenerative equipment for one car, £326 10s.
Dick, Kerr & Co.—Five pairs of 40-H.P. interpole motors, £192 10s. per pair.
Siemens Bros. Dynamo Works, Ltd.—Five pairs of 32 H.P. interpole motors, £187 per pair.
British Thomson-Houston Co.—10 pairs of controllers (B 18 type), £47 per pair.
W. Boydell & Sons.—Resistances, £7 per pair.
J. Baker & Co., Rotherham.—30 pairs of wheels and axles £11 9s. per pair.
Angleur Co., Liège (Belgium).—300 to 400 tons of rails.

Leyton.—The U.D.C. received the following tenders for a commutator for one of the smaller lighting dynamos :—

Westminster Engineering Co.	(accepted)	£45
.. ..	(alternative)	54
India-Rubber, Gutta-Percha & Telegraph Works		60
Mather & Platt, Ltd.	(makers of the machine)	118

London.—The L.C.C. has extended Messrs. Campbell, Macmaster & Co.'s (castings department) contract for the supply and delivery of cast-iron stopping sign frames for the tramways department, by the year ending next December.

WOOLWICH.—The B.C. received the following tenders for the supply of cast-iron pipework required in the construction of the cooling pond at Plumstead electricity works :—

Aiton & Co.	£160	Mackenzie & Moncur	£203
John Spencer, Ltd.	168	Ledward & Beckett	256
Seagers, Ltd. .. .. (accepted)	170	Fraser & Chalmers	408

SOUTHWARK.—The tender of Messrs. Alfred Blackmore & Co., of 2, St. Michael's House, Cornhill, at 11s. 4d. per ton, has been accepted for 6,000 tons of Griff or Kingsbury peas, ⅝-in. to ¼-in. screened, for use at the Southwark electricity works.

Manchester.—Tenders have been accepted by the Tramways Committee as under :—

Brush Electrical Engineering Co.—38 pairs maximum traction tramway trucks.
Henry Wallwork & Co., Manchester.—Car resistances.
Walter Scott, Ltd., Leeds.—600 tons of steel girder tramway rails.

The Electricity Committee has accepted the following tenders :—

Newton, Chambers & Co.—Low-pressure pipework at the Stuart Street station.
C. H. Normanton & Sons.—Foundation, &c., for turbo-generator at Stuart Street station. Necessary ironwork will be supplied by De Bergne & Co.

Portsmouth.—For the supply of two refuse destructors at Baffins and Eastney, the T.C. received the following tenders :—

		Baffins.	Eastney.
Heenan & Froude	(accepted)	£14,465	£14,430
Hughes & Sterling		12,116	13,825
Manlove, Alliott & Co.		13,880	13,884
Goddard, Massey & Warner		12,926	14,553
Horsfall Destructor Co.		15,490	15,513

Salford.—The T.C. Tramways Committee has accepted the tender of Messrs. J. Gerrard & Sons, Ltd., at £346, for the erection of a water tower at the central car depôt. The offer of Mason & Jacob, Ltd., to print advertisements on the backs of 5,000,000 tram tickets, at the rate of £6 per 1,000,000 tickets, has been accepted by the Council. For carrying out the additional electric lighting installation in the car-fitting shops, &c., at the car depôt, the tender of G. Hill & Co., Manchester, has been accepted, at £94.

South Africa.—According to the *British and South African Export Gazette*, the Uitenhage T.C. have accepted the offer of the General Electric Co., Ltd., London, for the public lighting of the town by electricity. The contract, if ratified by the ratepayers, will mean the supply of 22,000 C.P., and the plant is to be taken over by the Council within 10 years.

Stoke-on-Trent.—The T.C. has accepted the tender of the Harris Patent Feed Water & Filter Co., Ltd., for a chemical oil eliminator for the electricity works, at £128.

Warrington.—The T.C. has accepted the tender of Messrs. W. & J. Richardson for the supply of slack to the electricity department.

Watford.—The U.D.C. on Tuesday placed the following contracts in connection with the electricity department :—

L. R. Ensor.—Buildings and flues.
Ashworth & Parker.—Fan engine.
J. Blakeborough & Sons.—Pipes.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDARE.—Workmen's dwellings, at Cwmbach (28) and Godreaman (22) for the U.D.C. Surveyor, Town Hall, Aberdare.

ASHTON-IN-MAKERFIELD.—New baths for the U.D.C. (£6,000).

AYLESBURY.—Houses, Alexander Road, for Webster & Cannon; Victoria Street, for Mr. Evett; Princes Road, for R. W. Locke.

AYLSHAM (NORFOLK).—Probable re-erection, after fire, of business premises, Red Lion Street, for the International Stores, Ltd.

BANBRIDGE (Co Down).—Extension of Technical School, or new two-storey building.

BANFF.—Conversion of Duff House into Hotel (£20,000). Mr. Van Praagh, managing director, c/o De Wynter & Co., Charing Cross Road, W.C.

BELFAST.—New factory, Wellwood Street, for Albion, Ltd. (£10,000). J. & R. Thompson, Ltd., builders.

BIRMINGHAM.—Prospective restoration, after fire, of chemical warehouse for Southall Brothers & Barclay, wholesale chemists.

BLACKPOOL.—New Skating Rink, Waterloo Road, South Shore. Jas. Fioni, architect, Blackpool.

BLEDLOW RIDGE (BUCKS.).—Detached house (£960). S. C. Hart, architect, 26, Bush Lane, E.C.

BOLTON.—Extensive alterations to premises in Knowsley Street, for Messrs. Redhead. Projected hospital laundry extension; borough surveyor.

BONNYRIGG (MIDLOTHIAN).—New offices for the Cockpen Parish Council. Greig, Fairbairn & Macniven, architects, 31, York Place, Edinburgh.

BRADFORD.—Proposed quarries at Esholt. City surveyor, Bradford.

BRIDGWATER.—Extension of Art and Technical Schools (£700). F. Parr, borough surveyor.

BRISTOL.—Extensions to All Saints' Church, Fishponds; Lingen-Barker, Son and Ellis, architects, 3, Unity Street, Bristol. Proposed Skating Rink in Rupert Street, for Rinkeries, Ltd.

BURNLEY.—New Council School in Gannow; two shops and 27 storerooms, Market Hall; house for Registrar at Cemetery. G. H. Pickles, borough surveyor, Town Hall.

BUXTON.—Shops, Bridge Street, for Mr. Holland; additions to house, White Knowl Road, for Mr. Riddick; additions to house, Silverlands, for the Executors of the late A. Wild.

CALNE (WILTS.).—School. C. H. Smith, architect, Buckhill, Chippenham.

CAMBRIDGE.—County School. H. Dunn, architect, Sydney Street, Cambridge.

CANTERBURY.—Villa Residence, Old Dover Road; J. W. Edwards, Hanover Place, Canterbury. House, Old Dover Road; W. Cozens, builder, Dover Street, Canterbury.

CARRICKFERGUS (Co. ANTRIM).—New technical schools.

CARSHALTON.—Houses, St. Andrew's Road, for Mr. Holden; Fairview Road, Windebank & Co., builders, St. Olaves, Mulgrave Road, Sutton; Cambridge Road, for J. Peto.

CLITHEROE.—Extensions to sewage works (£6,500). Borough Surveyor, Clitheroe.

COLWYN BAY.—Public pavilion, Greenfield Road. Chas. Clegg & Sons, architects, 104, King Street, Manchester.

CORK.—Prospective restoration, after fire, of portion of the Cork Catholic Young Men's Society Hall, Castle Street. Convalescent home; S. F. Hynes, architect, 41, South Mall, Cork; E. & P. O'Flynn, builders, Cork.

CREWE.—Proposed new railway orphanage. L. & N.W. Railway Co., Euston.

DERRY.—New Carnegie Library on site of Sir Edward Reid's Market (£8,000). M. A. Robinson, architect, 3, Richard Street, Derry.

DEWSBURY.—New Empire Palace of Varieties; Chadwick & Watson, architects, 9, Albion Street, Leeds. New church at Purlwell (£7,000); Mr. Hoare, architect, London. Prospective rebuilding of woollen cloth factory at Birstall, for Hirst & Sons.

DUDLEY.—Model bakery for the Co-operative Society (£2,000 to £3,000).

DUNTON BASSETT (LEICESTERSHIRE).—County School for Leicestershire County Council. C. Fowler, architect, 38, Bowling Green Street, Leicester.

EARLEY (near READING).—Suggested parish hall.

EGREMONT (CHES.).—Four shops, Liscard Road. J. Williams, 204, Poulton Road, Seacombe.

ELTHAM.—Sunday school and Mission Hall, Elibank Road. Building Committee of "The Brethren," per W. H. Smith, 5, Great Winchester Street, E.C.

ENFIELD.—Additions to the Workhouse, for the Enfield and Edmonton B.G. (£10,100).

EXETER.—Mineral water factory. R. M. Challice, surveyor, 14, Bedford Circus, Exeter.

FENTON (STAFFS.).—Additions to Crown Bakery (£500). Elijah Jones and Jackson, architects, 10, Albion Street, Hanley; S. Heath, builder, Basford, Stoke-on-Trent.

GILLINGHAM.—Proposed extensive additions to Byron Road schools for the T.C. F. C. Boucher, clerk to the Education Committee.

GLAMORGAN.—Proposed new schools at Pontardawe (200 children) and Pyle (350) for the C.C. T. Mansel Franklin, clerk to the C.C., Cardiff.

GOLCAR.—Two semi-detached residences at Wellhouse. J. Berry, architect, 3, Market Place, Huddersfield.

GRANGE-OVER-SANDS.—Rebuilding Crown Hotel. J. W. Grundy & Son architects, Central Buildings, Ulverston.

HANLEY.—Sixteen houses, Eastbourne Road; J. Cummings. Two houses, Eaton Street; W. H. Johnson. Alterations to shop, 19, Lichfield Street; W. Stedman.

HAYDOCK (SOUTH LANCS.).—New St. Mark's Church.

HERTFORD.—Dry cleaning works and carpet beating factory for the Steam Laundry Co. Joseph & Smithem, architects, 83, Queen Street, London; Henry Norris & Son, builders, Priory Works, Hertford.

HEXHAM.—Secondary school (240 places). Oliver, Leeson & Wood, architects, Milburn House, Newcastle.

HINCKLEY.—Sewage works for the U.D.C. (£2,889).

HONLEY (YORKS.).—Houses, Bradshaw Road, for Mrs. Eliza Cave and John A. Brook; Nelley, for Holmfirth U.D.C.

HULL.—Houses, Devon Street, for Mrs. P. Smith; Victoria Avenue, for R. Robinson; Stirling Street, for F. Allon, builder, Clifton Street; Stirling Street, for J. Jordan; Holderness Road, for J. Ward; Marlborough Avenue, for J. E. Wray; Folkestone Street, for C. Dixon; Anlaby Road, for T. J. Watts, builder, 234, St. George's Road; Exmouth Street, for Lison & Harris; houses and shops, Marfleet, for G. Wardle; warehouse, 242, Holderness Road, for H. Manham; warehouse, Clarence Street, for J. Rank, Ltd., millers; alterations to 80 and 82, Prospect Street, for the Royal London Mutual Insurance Society, Ltd.; warehouse, Humber Street, for J. Handcock, builder, 88, Waterloo Street; alterations and additions, High Street, for W. & H. Johnson; lock-up shops, Walton Street, for T. W. Wrigglesworth.

HUNSLET.—New offices for the R.D.C. B. Wood Higgins, architect, Oulton near Leeds.

ILFORD.—New parish hall for All Saints', Goodmayes. Rev. H. Reindorp, vicar, 7, Broomhill Road.

KENDAL.—Parkside Lodge, for the Committee of the Westmorland Consumption Sanatorium. J. Hutton, architect, Kendal.

LANCASTER.—Houses, Ashfield Avenue, for W. J. Edmondson; Ashfield Avenue, for W. H. Hall; High Caton Road, for J. R. Patterson.

LINTHWAITE.—Houses and shops, Hoylehouse, for A. Schofield; houses, Western Road, for J. Wimpenny & Co.

LONDON (EAST HAM, E.).—Residence in Boundary Road for the Medical Officer. A. H. Campbell, borough engineer, Town Hall, East Ham, E.

(ROTHERHITHE, S.E.).—Partial reconstruction of, and additions to, the Desiccated Grain Co.'s factory. Wreford & Wright, architects, 317, High Holborn, W.C.

(PLUMSTEAD, S.E.).—Probable rebuilding, after fire, of Primitive Methodist Chapel, junction of Robert Street and Glyndon Road.

(WALTHAMSTOW.).—Dining Rooms, Hale End Road; A. G. Barton, builder, Daventry Works, Walthamstow, N.E. Factory, Pearl Road; West Bros. & Pettet, builders, Pearl Road, Walthamstow.

LONGSHOOT.—Sixteen houses. W. Tattersall, architect, Haslingden.

LUTTERWORTH.—Houses, Gilmorton Road. P. Rourke, builder.

LYE (WORCESTERSHIRE).—School. H. Rowe & Son, architects, Worcester Chambers, Pierpoint Street, Worcester.

MACCLESFIELD.—Proposed nurses' home for the B.G. A. E. Bradburn, architect, 19, King Edward Street, Macclesfield.

MACHYNLLETH.—Drill hall for the D Company, 7th Merioneth and Montgomeryshire Welsh Fusiliers; new Post Office; and new shop for J. Evans, ironmonger.

MANCHESTER.—New United Methodist Sunday School at Culcheth, Newton Heath; contemplated alterations and improvements at Empress Brewery Co., Ltd.; Cornbrook Brewery Co., Ltd., and Therfalls Brewery Co., Ltd. New Wesleyan Church, Reddish Lane, Aspinall (£5,000 to £6,000).

MORECAMBE.—Public conveniences for the T.C. (£2,000).

MORLEY.—Alterations and additions to Peel Street Mills. T. A. Buttery, architect, Queen Street, Morley.

MOTHERWELL, N.B.—Prospective rebuilding, after fire, of offices (including telephone exchange), Muir Street, for the Caledonian Railway. School, Knowetop district (£12,600); J. Cowie, architect, 32, Brandon Street, Motherwell.

NEWARK.—Proposed new building, or adaptation of old Grammar School, for public museum and art gallery.

NEW BILTON.—Church institute. J. Liddington, architect, Regent Street, Rugby.

NEWBOLD VERDON (LEICESTER).—County school for Leicestershire County Council. C. Fowler, architect, 33, Bowling Green Street, Leicester.

NEWTOWN (GLOS.).—School. R. S. Phillips, architect, The Cross, Gloucester.

NORTHAMPTON.—Additions to Roebuck Inn, Grafton Street, for P. Phipps and Co., Ltd.; additions to 27, College Street, Trustees of Baptist Chapel; 25 houses, Wellingborough Road, for Sir Henry Randall; alterations and new warehouse, 148, Wellingborough Road, for C. Ruffhead.

NOTTINGHAM.—Extensive additions to clothing factory, Garden Street, Radford, for Wm. Hollins & Co. (£15,000).

OLDBURY.—Houses, Barclay Road, for W. Webb; West Bromwich Street, for A. Hassell; Barclay Road, for A. W. Burns; Katherine Road, for Thos. Myatt; Frederick Road, for A. Bishop. Schools at Abbey Road, Warley, and caretaker's house (£9,880); Wm. Jackson, builder, Oldbury.

OLD FLETTON (HUNTS).—New Commercial and Technical School for the C.C. County surveyor, High Street, Huntingdon.

OSSETT.—Sunday schools (£1,700). J. B. Thornley, architect, Darwen.

PENZANCE.—Two houses and shops, Market Jew Street, for John Matthews. N. C. Whear, jun., architect, Holbein House, Alexander Road, Penzance.

PICKERING.—Repairs to the Roman Catholic Church, after fire.

PRESTOLEE (LANCS.).—New elementary school (500 children). Lancs. Education Committee.

READING.—Additions and alterations to Reading School; Ravenscroft, Son and Morris, 22, The Forbury, Reading, architects. Parish Hall; Rev. W. J. Holloway, 9, Brunswick Hill, Reading.

ROCHFORD.—New building at the Infirmary, for the Board of Guardians.

ROTHERHAM.—Mission Church; Jas. E. Knight, architect, 33, College Street. Houses, Wortley Road, for Wm. Charles; Fitzwilliam Road, for John Lee; Albion Road, for J. F. Stuttard; Gerard Road, for Richard Snell; Albion Road, for Dr. J. W. Fox; St. Ann's Road, for Watt & Ferguson; schools, for the managers of the Roman Catholic Schools, St. Bede's Road.

SALFORD.—Conversion of premises in Blackfriars Road and Garden Lane into Public Assembly Rooms; additions to dye works, Meadow Road, Higher Broughton. Alterations to Gardeners' Arms public house, 9 and 11, Pendleton Street, Pendleton; alterations to Peeping Tom public-house, Regent Road.

SALISBURY.—Workshop, stores, &c., Friary Lane, for the T.C. W. J. Goodwin, city surveyor.

SHANKLIN (I. OF W.).—Kursaal. F. Matcham & Co., architects, 9, Warwick Court, Holborn, W.C.

SHEPSHED.—Factory, Charnwood Road, for R. Walker & Son.

SKELMANTHORPE (YORKS.).—Residence in Busker Lane. J. Berry, architect, 9, Market Place, Huddersfield.

SOUTHAMPTON.—New graving dock for the London and South-Western Railway.

SOUTHSEA.—Rebuilding of business premises, Palmerston Road, for Knight and Lee, Ltd., drapers.

STIRLING.—Proposed model lodging house. A. H. Goudie, burgh surveyor, Stirling.

STOKE-ON-TRENT.—Alterations to Primitive Methodist Church (£490). E. Jones & Jackson, architects, 10, Albion Street, Hanley; Bennett Bros., builders, Newcastle Street, Burslem.

SUTTON BONNINGTON (NOTTS.).—Prospective rebuilding, after fire, of St. Anne's Manor, for Major Tennant.

SWINTON (near MANCHESTER).—Opening new pits on Swinton Moss, for Lord Ellesmere. Capt. H. V. Hart-Davis, Bridgwater Offices, Walkden, Manchester.

TAMWORTH.—Probable restoration, after fire, of premises in Market Street, for F. G. Allton, grocer.

TAUNTON.—Extensive alterations to Victoria Rooms for stage plays, &c.; F. W. Roberts, architect, Hammet Street, Taunton. Row of residences at Rose Meadow; Fred Small, builder, Taunton.

THURNSCOE (near ROTHERHAM).—Important alterations and improvements at the sewerage disposal works, for the U.D.C. H. Smith, engineer, Compton Buildings, Bow Street, Keighley.

TORQUAY.—Probable reinstatement, after fire, of premises at 33, Fleet Street. D. P. Masters, tailor, occupier.

TREHARRIS (GLAM.).—New school at Nelson, for C.C. T. Mansel Franklin, clerk to the C.C., Westgate Street, Cardiff.

TULLAMORE.—New Post Office. H. Williams, secretary, Office of Public Works, Dublin.

TUXFORD (near NEWARK-ON-TRENT).—Proposed Sanatorium for Consumptives, for Sheffield T.C.

WALLINGTON (SURREY).—Houses, Hall Road, for A. J. Morriss; Mint Road, for W. Baldwin.

WALTON-ON-THE-NAZE.—Pair of villas, Seaville Crescent, South Cliff, for H. S. Wilson, Sudbury; bungalow and stables, Green Lanes, for G. W. Dossett, Theydon Bois.

WARRINGTON.—Administrative Hospital block at Sankey; T. Longdin, borough surveyor. New works at Aspley, for Gartons, Ltd.; workshop, Napier Street, for E. Forshaw & Sons, Ltd.

WHITEHEAD (Co. ANTRIM).—New Masonic Hall. C. A. Aitkin, architect, 20, Rosemary Street, Belfast.

WIGAN.—Christ Church, Milligate; Trustees, Protestant Church Mission. Houses and shops, Park Road; J. Wilson & Co., builders, 14, Caroline Street, Wigan. Three houses, Northumberland Street; A. Sharples, builder, Essex Street, Wigan. Four houses, William Street, for W. Knowles; six houses, Ridyard Street, for Mrs. M. A. Swift; alterations to Central Hall, King Street, for the World-in-Motion Co., Ltd. New school at New Springs; H. Littler, county architect, Preston.

WINTERBOURNE (GLOS.).—School. R. S. Phillips, architect, The Cross, Gloucester.

WOLVERHAMPTON.—Prospective rebuilding, after fire, of portion of factory, for Bayliss, Jones & Bayliss, ironworkers, Cable Street, Monmore Green.

YEADON (near LEEDS).—Secondary school, for the West Riding of Yorks C.C. (£9,931).

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 8th. At 8 p.m. At the Holborn Restaurant. Smoking concert.

Association of Engineers-in-Charge.—Saturday, January 9th. At 7.30 p.m. At St. Bride's Institute, E.C. Social and dance.

Institution of Mechanical Engineers (Graduates' Association).—Monday, January 11th. At 8 p.m. Paper on "Motor-Car Construction and Design," by Mr. R. V. Vining.

Institution of Electrical Engineers (Newcastle Section).—Monday, January 11th. At 8 p.m. Paper on "Method in Invention," by Mr. C. Turnbull.

Institution of Electrical Engineers (Manchester Section).—Tuesday, January 12th. At 7.30 p.m. At the University, Manchester. Paper on "The Improvement of Power Factor in Alternating-Current Systems," by Mr. M. Walker.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, January 12th. At 8 p.m. Meeting at 207, Bath Street, Glasgow.

Association of Engineers-in-Charge.—Wednesday, January 13th. At 7.30 p.m. At St. Bride's Institute. Paper on "Water and its Impurities," by Mr. J. B. C. Kershaw.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, January 13th. At 7.30 p.m. At the University, Birmingham. Paper on "Practical Considerations in the Selection of Turbo-Alternators," by Dr. M. Kloss.

Junior Institution of Engineers.—Thursday, January 14th. At 7.30 p.m. At the Royal United Service Institution. Lecture on "The Laws of Heat Transmission in Steam Boilers, as Deduced from Experiment," by Prof. J. T. Nicholson.

Institution of Electrical Engineers (Dublin Section).—Thursday, January 14th. At 8 p.m. Meeting at the Royal College of Science.

Rugby Engineering Society.—Thursday, January 14th. At 8 p.m. At Benn Buildings, Rugby. Lecture on "Steam Boilers," by Mr. D. Wilson.

Institution of Electrical Engineers.—Thursday, January 14th. At 8 p.m. At the Institution of Civil Engineers. Paper on "The G.B. System from a Tramway Manager's Point of View," by Mr. S. Clegg.

Institution of Electrical Engineers (Glasgow Students' Section).—Meeting on Friday January 15th. At 8 p.m. At the Technical College, Glasgow.

Northampton Institute Engineering Society.—Friday, January 15th. Paper on "Proportionment of Armature Teeth," by Mr. H. K. Whitehorn.

Junior Institution of Engineers.—Saturday, January 16th. At 3 p.m. Visit to the engineering laboratories and workshops of the Central Technical College, South Kensington, S.W.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Monday, January 11th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.
Tuesday, January 12th.—"B" Company. Technical drill, 6 to 8.30 p.m. Infantry drill, 8.45 to 9.45 p.m.
Tuesday, January 12th.—Medical inspection for recruits, 6.30 to 7.30 p.m.
Thursday, January 14th.—"C" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.
Friday, January 15th.—"D" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7.45 to 9.30 p.m.
Arms will be issued to recruits on January 11th, 12th, 14th and 15th.

(Signed) J. H. S. PHILLIPS,
Capt. and Acting Adjutant.

NOTES.

Telephone Specification.—A correspondent draws our attention to the specification recently issued for the installation of telephones at the Birmingham Workhouse. In Clause 2 of the Conditions of Contract we read: "Should anything have been omitted from the said specification and schedule which from the nature of the work should in the judgment of the engineer have been included, the same shall be executed by the contractor without extra charge."

Here we have, as so often happens, the engineer appointed to draw up the specification and schedules apparently endeavouring to evade responsibility for their accuracy and completeness, and to saddle the contractor with the liability to make good his (the engineer's) errors of omission. Is this a manly attitude? Surely it is the prime function of a consulting engineer to know what is wanted, to see that it is specified and scheduled, and to bear the responsibility for its proper execution in every detail.

Again, in Clause 9, the old injustice reappears: "In the event of any question or dispute whatsoever arising . . . . the decision of the engineer shall be final and binding upon both parties of the contract, without appealing to any Court or process whatsoever." To accept this is to put one's head into the lion's mouth, and trust to his amiability, while arguing as to the justice of his claim to bite it off. A similar prerogative is claimed in Clause 15.

Possibly these clauses were drawn up by a lawyer; we hope so, as we should not like to think that an engineer was the author of them. It is very regrettable that contractors should be found who would accept work under such conditions; our correspondent, being a member of the Contractors' Association, declines to do so.

Electric Shock Fatalities.—An inquest was held on 28th ult. at Moorgreen Colliery into the cause of death of Charles W. Thomson, which occurred at the colliery company's power station while he was engaged, as he was from 14th to 24th ult., on behalf of the British Westinghouse Co., in a cubicle at the rear of one of the switchboards. It appeared from the evidence that deceased was 25 years of age; he arrived in this country two years ago, after gaining several diplomas in New Zealand, where he had served for six years in various workshops, and was a Bachelor of Science of Dunedin (New Zealand) University. He had been on the British Westinghouse Co.'s books for 19 months.

According to the report of the inquest appearing in the *Nottingham Guardian* of December 29th, Mr. C. J. Bish, of the British Westinghouse Co., supervisor of the installation of switchgear, in his evidence, said that deceased was sent alone to do the work, and witness personally gave him his instructions. Deceased was engaged in the construction of the extension itself in the Manchester shop before its removal. The deceased would be familiar with the requirements of the work, but it was not his duty to get into the cubicle in which he was found. He had apparently finished his work in that cubicle, the second from the end, and was working that day in the third, which was cut off and was safe. He should have been working in the third cubicle, but for some unknown reason he returned to the second and met with his death there by an electric shock, through coming into contact with two live pieces of iron in the cubicle. He was burned across the nose and on the back of the hand. He omitted to remove the plugs in the roof of the cubicle, which would have immediately broken the circuit, and when doing some work he came in contact with "live" metal. He was working under the instructions of Mr. Routledge, the chief electrical engineer for Messrs. Barber, Walker & Co.'s Eastwood Collieries, and had received no written orders from the Westinghouse Co. He ought not to have entered the second cubicle without permission from Mr. Routledge. He saw some pieces of skin adhering to the terminal. The pressure would be 3,000 volts, and he would consider 200 volts sufficient to make death instantaneous. He went to work at half-past nine on Thursday morning, and had worked until about midnight the previous night. He was not tied for time by the company, but he had written asking for leave for the Christmas holidays, and he was no doubt hurrying in his own interests. There was no regulation on paper preventing him from entering the cubicle without permission from the local engineer, but it was an understood regulation; he was doing wrong if he went in without Mr. Routledge's instructions. Deceased was anxious to get away to Edinburgh and was apparently excited in that respect, and this might have caused him to do a little bit of work without taking the trouble to take the plugs out. It would only have taken two or three minutes to do this, and then he would have been perfectly safe.

Mr. L. G. F. Routledge said electric plant had been installed for nine months. An additional machine was installed, and this required an extension of the switchboard. Deceased was engaged on the work and appeared to be very careful. He worked late every night that week, and witness was always about the place while the work was on. He did not allow deceased to go to a cubicle without permission, and he had not done so previously. They did not touch any high-tension work unless it was "dead." The door of the second cubicle was locked previously, and deceased was working in the third when witness was there, but when witness arrived he had been pulled out of the second cubicle. They had no printed rules put up in the house. Deceased had not expressed a desire to get away that afternoon. There was a notice on the iron doors leading behind about the entry to cubicles, and witness had warned deceased not to enter. Deceased was doing something in connection with the wiring to the Tirrill regulator, and he must have been leaning over, to get his nose on the terminal. He would have received a shock if he had simply put his hand on, but not such a severe one. The work in the second cubicle was finished the day before, and he could not tell why deceased had revisited it.

Dr. Gillespie said artificial respiration was tried for more than an hour, but without effect. He considered death was instantaneous.

Mr. Nelson, of Brook Green, London (the recently-appointed Electrical Inspector of Mines), said that in his opinion the accident was caused by neglect of proper precaution, and the neglect consisted in not removing the safety plugs. He thought that probably this was due to momentary forgetfulness on the part of the deceased. He thought no blame attached to anyone. At the same time he was of opinion that there had been a certain laxity in the handling of the keys. It should not have been possible for the deceased to obtain possession of the keys without the knowledge of the man in charge of the switchboard. He strongly recommended that definite rules should be drawn up, and that the keys should be left in the possession of the man at the switchboard, and that he, and he alone, must do any unlocking. He would also suggest that as a precaution no bare "live" metal be left in front of or behind the switchboard, and that the terminals should be insulated just as the leads from the switch were covered.

The jury returned a verdict that "Deceased was accidentally killed by coming in contact with an electrical terminal," and considered that the accident was due to some oversight on the part of the deceased himself.

According to a report in the *Daily Chronicle*, an electrician's labourer, named Reader, aged 45, met his death at the Lot's Road Power Station, Chelsea, some days ago. It was stated that Reader had been engaged upon electrical work all his life. Dr. T. M. Ross stated that when called to the electric station he saw the body of the man in one of the corridors. There was then no sign of singeing or burning, but there was a smell of tarry paint like naphtha or benzine. He found a charred and whitened mass near the right elbow. All the organs were healthy, but from the congested appearance and the condition of the blood he had no doubt that deceased had been killed by electricity. The perspiration pointed to the man having fainted, and that condition would intensify the current. In answer to Mr. Washington (appearing for the family), witness said the heat or the closeness of the atmosphere might have caused faintness.

James Gough, the foreman of the boiler house, said the deceased was painting one of the boilers, measuring 4 ft. 6 in. × 23 ft. There was no electricity in the boiler except the lamp deceased was using, and that was found broken. It carried a voltage of 220. In answer to Mr. Roberts, who appeared for the employers, the witness said that deceased had been working on his knees, and being tired, slipped when about to change his position.

The inquiry was adjourned for the jury to inspect the scene of the accident and to obtain expert evidence.

Poisonous Gases in Factories.—The *Times* of January 4th contains a notice of a memorandum issued by the Home Office as to the use of water gas, suction gas and other gases in factories. Attention is called to the fact that in recent years there has been a great extension of the manufacture and use of suction, Dowson, Mond, power, producer, blast-furnace and other gases for industrial purposes, and that in 1899 a Departmental Committee recommended that the manufacture and distribution for heating and lighting purposes of any poisonous gas which did not contain a distinct and pungent smell should be prohibited, and that regulations should be made limiting the proportion of carbonic oxide. It is pointed out that the particular danger associated with all these gases is that of poisoning by carbonic oxide (carbon monoxide, CO), the proportion of which reaches 30 per cent. in carburetted water gas and 50 per cent. in uncarburetted water gas, compared with from 4 to 12 per cent. in coal gas. The other gases usually contain from 10 to 25 per cent. The annual reports of the Factory Department show that in the five years 1899 to 1903 there were 51 cases of carbonic oxide poisoning, 17 of which were fatal; 18 fatal cases out of 57 in the two years 1904 and 1905, and 14 fatal cases out of 136 in the two years 1906 and 1907, the lessened mortality being due, possibly, to better knowledge of the methods of resuscitation. It is further stated that "carbonic oxide poisoning may occur in other ways apart from the manufacture or use of the particular gases named. Thus danger of this kind may arise in laundries from the use of gas irons, and in workrooms from defective gas fittings (especially absence of stop-pins indicating the cutting-off of gas) and from gas stoves not provided with chimneys or flues for carrying off the products of combustion. The absence of a chimney in a room greatly increases the risk. Carbonic oxide is found also in lime kilns, cement works, and where braziers and coke fires are used in confined spaces." The memorandum contains a list of preventive measures of general application which should be adopted, describes the symptoms of carbonic oxide poisoning, and suggests the method of "first aid" treatment of those who may become affected by it.

Revocation of Patents.—The decision of the Comptroller-General of Patents, in the matter of an application for the revocation of a patent for an American sewing machine, on the ground that it was not manufactured in the United Kingdom, was issued on Monday. The machine was manufactured in the United States, but before it was sold in this country a few parts were taken out and stronger ones, manufactured in this country, substituted. The Comptroller-General ruled that the American patentees had not adequately worked their patent in England by merely making a small number of substituted parts. An allegation put forward by the defence, that the necessary tools and the highly-skilled labour required to make the machines could not be procured in this country, was rejected by the Comptroller-General. The patent in question had less than two years to run.

A new X-ray apparatus, of American origin, is to be made in this country by Messrs. Newton & Co., in order to prevent the revocation of the patent under which it is made.

The suggestion noticed in our last issue, and in a leaderette to-day, that a patent would be "adequately worked" if the parts manufactured abroad were merely assembled in this country, is repudiated by experts on patent law, who agree that no general rule can be laid down; each case will be judged on its own merits. An interesting article on the procedure to be followed in applying for the revocation of a patent appears in the *Times* of January 2nd, from which it appears that the costs of the process are not excessive—from 50 to 75 guineas inclusive. It is estimated that the number of foreign applications for British patents has fallen by 8½ per cent.

Writing to the *Times* of January 6th, a "Chartered Patent Agent" says that "the reason why it was popularly expected that actual manufacture in Great Britain would be a necessary sequence to proceedings under Sec. 27 is that it is practically the case in all other countries where the Patent Acts contain similar clauses. The difference is, however, that these countries use the provisions as to the working of patented inventions in a protective sense, whereas Great Britain alone appears to desire to deal with the matter in a free-trade sense. Some of your recent correspondents on this subject appear to be under the impression that more benefit results to the community at large by a slight reduction in price to the consumer in the case of an article which is imported from abroad than if that article is manufactured in the country and sold at even a slightly increased price. I think the working man would unhesitatingly say that the benefit to him will come from establishment of the manufacture in this country, as it will put money into his pocket, without which the price at which the imported article is sold concerns him not at all.

"It is now open to the foreign patentee to follow one of two courses. In the first place, where he knows that he can manufacture his improved article abroad and import it into England at a price slightly lower than that at which it could be sold if manufactured in England, he will refrain from making application for a British patent. There will similarly be no object in obtaining a British patent in the case of a complicated machine which the patentee knows well is not likely to be made by anyone who does not hold the monopoly. The other course open to the foreign patentee is to apply for and obtain a British patent, but allow it to lapse at the end of the fourth year before any question of proceedings under Sec. 27 can arise. During these four years the patentee has had the monopoly, and will have been able to obtain such an advantage on the English market with his imported goods that he can in a large majority of cases disregard the competition resulting from anyone who subsequently desires to manufacture in Great Britain. Manufacture abroad and importation by a competitor can easily be prevented by the obtainment of patents covering the likely countries, the patentee himself naturally manufacturing where the work can be done most cheaply, and thus complying with the local requirements as to working.

"I shall be glad to have it pointed out where the country is going to benefit in either of these cases, which I may say are not at all imaginary. So far from being a gainer, England will actually be the loser by the amount of the fees on the patents which will not be applied for or kept up."

Electrical Winding in South Wales.—In our article on the above subject in our last issue, we mention on page 23 that the price paid for energy is "slightly in excess of ½d. per unit." The price of ½d. per unit was taken as a basis in making the comparison with a steam-winding plant using coal at 7s. 6d. per ton, which is given lower down the page; the estimates for the electrical winder include 838,950 units at ½d. per unit, *not ½d. as printed in error*, giving a total of £1,746 16s. 3d., as shown. We recur to this matter, as obviously with the higher figure for electrical energy, the comparison is more favourable to electrical winding.

Institution and Lecture Notes.—THE JUNIOR INSTITUTION OF ENGINEERS.—At the last meeting of this Institution, a paper on "Motor-Omnibuses," by Mr. Eric F. Boult, was read and discussed. A visit to the shops of the London General Omnibus Co., at Walthamstow, took place on the Saturday afternoon previously, and was numerously attended. On leaving the garage the members were shown over an adjoining factory, which has just been erected for the Micanite and Insulators Co., affording an excellent illustration of the planning and laying out of such premises.

LIVERPOOL ENGINEERING SOCIETY.—"Electric Railways" was the subject of a paper read before the Society recently by Prof. Gisbert Kapp. With the aid of lantern slides, the lecturer traced the history of electric railways, and said their rapid development was due to their enormous superiority to steam in the matter of frequency of running, speed of transit, and comfort; while with regard to expense, although it was yet doubtful which was cheapest, yet electricity had many staunch advocates, and several countries had adopted it as the best and cheapest. The relative advantages of three types of current supply—direct, single and three-phase alternating—were dealt with, Prof. Kapp stating that in future he expected the single-phase supply would be adopted for main line working, because of the possibility of having one overhead conductor, and thus reducing the difficulty of collecting to a minimum. In reviewing the most important electric railways in England, Dr. Kapp remarked that the Liverpool and Southport line was one of the most successful lines in the kingdom, being of purely English design and workmanship, and free altogether from American practice.

ASSOCIATION OF PUBLIC SCHOOL SCIENCE MASTERS.—The annual meeting of the members of this Association is to be held at Merchant Taylors' School, Charterhouse Square, on Tuesday, January 12th. In the morning the president, Sir Clifford Allbutt, F.R.S., will give an address on "The Relation of General to Technical Science Teaching," and in the afternoon there will be a discussion on "Science Curricula in Public Schools." During the day papers will be read, and there will be an exhibition of scientific apparatus and books.

Electrical Football League.—On Saturday last, January 2nd, the General Electric F.C. defeated the Ediswan F.C. by 5 goals to nil at Ealing. Next Saturday (to-morrow) Messrs. Robertson's Lamps entertain St. James' Electric at Gunnersbury Avenue, the kick-off taking place at 2.30 p.m.

European Water-Powers.—In considering the water-powers of the several Continental countries, a German engineer, Otto Mayr, arrives at the following conclusions:—Norway leads with 7,525,000 H.P. available, of which only 301,000, or 4·00 per cent. is utilised; Sweden follows with 6,750,000 H.P. available and 200,000, or 2·9 per cent., used; Italy, with 5,500,000 H.P. available, and 464,000, or 8·43 per cent., used; France, 5,524,000 H.P. available, and 1,190,800, or 21·50. per cent., used; Austria, 5,125,000 H.P. available, and 450,000, or 8·78 per cent., used; Germany, 1,677,600 H.P. available, and 503,300, or 30·01 per cent., used; Switzerland, 1,500,000 H.P. available, and 380,000, or 25·33 per cent., used; and Hungary, 550,000 H.P. available, and 65,000, or 11·81 per cent., used. These figures give a total of 34,151,600 H.P. available for the whole Continent, of which only 3,554,100 H.P., or 10·41 per cent., is utilised. They are, however, only a rough approximation, as, in the case of Italy and Switzerland, the data are brought down to the end of 1905 only, and in the case of France and Germany they are for the year 1907. With regard to Italy, the *Giornale dei Lavori Publici* remarks that at the end of 1906 the water-power used totalled 830,000 H.P., or a percentage of 15·27 per cent. Of this 830,000 H.P., 740,000 was transformed into electrical energy and 90,000 applied directly.

Legal.—According to the *Edinburgh Evening News*, Sheriff Orr has issued his interlocutor in the case of the General Electric Co., Ltd., London, who sued Pratt Bros., electricians, Edinburgh, in Edinburgh Sheriff Court for £267 17s. 11d., the amount of their account against defenders for electric lamp-holders and lamps, &c., supplied in connection with the decorative lighting of the recent Edinburgh Exhibition, for part of which defenders were contractors. Defenders admitted the account, subject to certain deductions, the chief of which was £50 claimed as damages for breach of contract in connection with supplying lamps. Defenders' case was that they ordered "Robertson" electric lamps, which bear the name "Robertson" stamped on the bulb, and are manufactured by pursuers. The lamps supplied bore no such name, and thus did not conform to the contract. Pursuers said that both parties came to an agreement whereby it was verbally arranged that the price per lamp be adjusted to 4½d. instead of the usual 7½d. for "Robertson" stamped lamps, and that no name be put on the lamps. This defenders denied. His Lordship's finding was that pursuers had failed to prove their averment that it was verbally arranged at the interview between parties at which the price was adjusted, that the lamps would not be stamped with the trade mark; that pursuers committed a breach of the contract, and he assessed the damages at £39; that defenders are entitled to a deduction of £5 7s. 10d. as discount; he grants decree for £222 9s. 9d., and holds pursuers liable in expenses to defenders to the amount of four-fifths.

Plant for Sale.—The Stockport Electricity Committee is offering various electrical and steam plant for sale. Some particulars are given in our advertisement pages to-day.

Blast-Furnace Igniter.—The operation of lighting-up a blast furnace has to be accomplished by way of the tuyères, usually with red-hot iron rods. At the Homestead Steel Works, U.S.A., an electrical device has been introduced, consisting of a pointed tube carrying two arc-light carbons, which are protected from contact with their surroundings, except in the neighbourhood of the arc, where the tube is cut away. Inflammable material is placed in the mouth of the tuyère, and the tube is then pushed into it; the carbons are connected to a source of current giving about 6 amperes at 60 to 80 volts, and the current passing through a small leaden bridge piece between the carbons melts this and sets up an arc, which ignites the priming. The air-blast being turned on blows the flames into the furnace, and thus sets fire to wood previously placed in position inside the furnace, which ignites the charge.

Salford Corporation Prosecutes Itself.—At the Salford Police Court on Wednesday the deputy town clerk appeared to prosecute the Corporation Electricity Committee for allowing black smoke to issue from the works chimney in Frederick Road, Pendleton. Mr. M'Cowen, the electrical engineer, said that the circumstances were exceptional, as they were testing coal, when one of the economisers broke down. A fine of 5s. was imposed, and an order was made for the nuisance to be abated.

Shoreditch Borough Council Contracts.—It is reported that the Shoreditch Borough Council decided on Wednesday to instruct each of the Standing Committees, when accepting tenders for ordinary goods, to give preference, where reasonably practicable, to goods of British manufacture. It will be remembered that Islington Council passed a similar resolution a few weeks ago.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. H. S. Taylor having resigned, on appointment to another position, his situation as mains superintendent to Hammersmith electricity undertaking, Mr. T. A. Taylor, Huddersfield, has been chosen to fill the vacancy at a commencing salary of £130 per annum, rising by £5 a year to a maximum of £150.

On January 4th Mr. Ralph U. Bailey, engineer-in-charge at the Birmingham Corporation Summer Lane electricity works, was married to Miss Lottie May Hunter, of Newcastle. The electricity works staff presented him with a handsome clock.

The Wednesbury Lighting Committee has been considering the reorganisation of the electricity staff, rendered necessary by the Corporation generating its own electricity. It has decided to make the following rearrangement, viz., to terminate the appointments of Mr. A. Franks as senior assistant, and Mr. J. P. Smith as junior assistant, at the electric sub-station, and to create on the permanent staff two shift engineers and one works or working engineer, in addition to the clerk already engaged. This involves an increase of one on the permanent staff, and is rendered necessary by the greater demand for electric power and the additional hours of attendance required at the electricity works. These positions have been filled by assistants already in the employ of the Corporation, either permanently or temporarily.

The Stockport Electricity Committee of the Corporation has recommended the Salaries Committee to increase the salary of Mr. Ralph Lomax, the electrical engineer, from £300 to £400 from January 1st, 1909. The Tramways Committee have also decided to appoint Mr. Lomax car-shed superintendent, at an additional salary of £50 per annum.

Tramway Officials.—The salary of Mr. John Telfer, tramways manager to Warrington Town Council, has been increased from £175 to £208 per annum, dating from June last.

General.—In November last, the Yorkshiremen's Society of New South Wales held a large gathering at Sydney to bid farewell to Mr. E. Kilburn Scott in connection with his departure for England. Mr. Scott was president of the Society. He was presented with a gold watch.

The *Times* reports that the Governors of the Merchant Venturers' Technical College, Bristol, have appointed Mr. William Morgan, B.Sc. of the University of London, to the newly-established chair of motor-car engineering.

Mr. A. C. Kelly has resigned from the position of traction engineer to the British Westinghouse Electric and Mfg. Co., Ltd., in order to join the staff of the Buenos Ayres and Pacific Railway Co., at Buenos Ayres.

Sir William Preece, deputy-chairman of the British Coalite Co., has become chairman of the company.

Mr. H B. Palmer has retired from the position of superintendent of the line for the Metropolitan Railway Co. In consequence, Mr. W. Holt has been appointed traffic superintendent, and he will also act as goods manager.

In the list of Indian honours issued on January 1st there appears the name of Mr. William King-Wood, officiating director, Persian Section of the Indo-European Telegraph Department, who is appointed a C.I.E.

Obituary.—Georges Charles Theodore Aboilard.—It is with much regret that we have to announce the death, on the night of the 30th ult., of M. Aboilard, one of the best known and most highly respected men in electrical circles in France. He was manager of the business in electrical wires and cables of the Maison Bonis until 19 years ago, when he assisted in forming, and has since actively managed, the business of the Société de Matériel Téléphonique, which organisation represents the Western Electric Co. in France. On the occasion of the Exhibition of 1900, he was made a chevalier of the Legion of Honour, and four years later was promoted to the grade of officer. Last week we mentioned M. Aboilard's firm in connection with the restoration of the Paris telephone service, but we have only learned since to what an extent the plan adopted for that restoration was due to his personal initiative and sound judgment. In early life he spent some years in England, and took an active part in British sports. The interest in England and English speaking peoples thus early formed he always retained, but his sympathies were wide. Amongst those who enjoyed his intimate acquaintance he was regarded as being of so essentially a kindly disposition as to render it impossible to be otherwise than a true friend, a real patriot, and a good citizen of the world. He sought for others to make "life a boon," and for such men truly "Death whene'er he call must call too soon," but to be suddenly cut off at the age of 56 is untimely indeed. The funeral took place on Saturday last, and was attended by a large concourse of sorrowing relatives, official representatives, colleagues and workpeople of his factory.

NEW COMPANIES REGISTERED.

Aluminium Founders, Ltd. (100,849).—This company was registered on December 24th, with a capital of £2 000 in £1 shares, to carry on the business of metal founders, electrical and general engineers. &c. The subscribers are:—E. E. Farmer, 89, White Hart Lane, Barnes, founder, 100 shares; Mrs. G. Farmer, 89, White Hart Lane, Barnes, 1 share; C. K. Graham, 30, Elm Grove Road, Barnes, engineer, 100 shares; Mrs. H. Graham, 30, Elm Grove Road, Barnes, 10 shares; R. F. Graham, 30, Elm Grove Road, Barnes, 2 shares. Private company. The number of directors is not to be less than two or more than four; the first are C. K. Graham (chairman), and E. Farmer; qualification, 100 shares; remuneration as fixed by the company. Registered offices, Raglan Street, Wolverhampton.

Auto-Controllers, Ltd. (100,844).—This company was registered on December 24th, with a capital of £800 in £1 shares, to acquire from R. H. Pearson and E. G. Bryant the benefit of certain existing inventions relating to automatic switches or auto-controllers, to develop and turn to account the same, and to carry on the business of electrical engineers, manufacturers of and dealers in electrical machinery, fittings and appliances, &c. The subscribers (with one share each) are:—R. H. Pearson, The Bungalow, Boscombe, Hants., engineer; E. G. Bryant, 6, Town Hall Avenue, Bournemouth, engineer. Private company. Table "A" mainly applies. Registered office, 4-5, Town Hall Chambers, Bournemouth.

Midland Electric Manufacturing Co., Ltd. (100,921).—This company has just been registered, with a capital of £3,000 in £1 shares, to take over the business of manufacturers of electrical appliances and fittings carried on by G. T. Thornhill, W. L. Barber and F. W. Abbott, at 140, Conybere Street, Birmingham, as the Midland Electric Manufacturing Co. The subscribers (with one share each) are:—W. L. Barber, Acocks Green, Worcester, electrical engineer; F. W. Abbott, Kenelm Road, Small Heath, Birmingham, electrical engineer. Private company. The first directors are G. T. Thornhill, W. L. Barber and F. W. Abbott; qualification, 200 shares. Registered office, 140, Conybere Street, Birmingham.

Standard Cable Manufacturing Co., Ltd. (100,967).—This company was registered on January 2nd, with a capital of £10,000 in £10 shares, to carry on the business of manufacturers and sellers of wires, cables and other articles and accessories required in the electrical and allied trades. The subscribers (with one share each) are:—F. Plutte, 18-19, Queenhithe, E.C., merchant; C. C. Rawlinson, 47, New Broad Street, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five: The first are C. N. W. A. Wenste, E. C. Carp, A. C. F. Haniel, T. Croon and F. Plutte (managing director); remuneration as fixed by the company. Registered office, 16-19, Queenhithe, E.C.

Motor and Industrial Engineering Co., Ltd. (100,965).—This company was registered on January 2nd, with a capital of £10,000 in £1 shares, to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in motor vehicles, magnetic, electric, telegraphic, telephonic and other apparatus, &c. The subscribers (with one share each) are:—H. N. Gardiner, 161, Lower Road, Rotherhithe; F. Bruce, 4, Union Court, E.C., clerk. Private company. Table "A" mainly applies. Registered office, 4, Union Court, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Fleetwood and District Electric Light and Power Syndicate, Ltd. (49,666).—Charge dated December 8th, 1908, to secure £1,125 and further sums not exceeding in all £1,700 created by receiver appointed on behalf of debenture holders. Property charged: Assets and undertaking ranking in priority to trust deed dated October 31st, 1899. Holder: W. C. Johnson, Broadstone Farm, Coleman's Hatch, Sussex.

Torquay Tramways Co., Ltd. (96,012).—Particulars of £60,000 debentures created November 26th, and secured by a trust deed dated December 8th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907. None of the debentures have yet been issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: L. B. Schlesinger and Sir Nathaniel Nathan.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Trust deed dated December 8th, 1908, to secure £100,000 debenture stock. Property charged: Freehold and leasehold buildings at Aberystwyth, leasehold premises at Chiswick, the benefit of two provisional orders, and the company's general assets, present and future, including uncalled capital. Trustees: General Investors and Trustees, Ltd., 75-6, Lombard Street, E.C.

Arc Lamps, Ltd. (London). (70,795).—Particulars of £5.000 debentures created December 18th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: The company's general assets, present and future, including uncalled capital. No trustees.

Havana Telephone Securities Co., Ltd. (London), (97,712).—Particulars of debentures created December 2nd, 1908, to secure not more than £246,250, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £126,880 6s. 3d. Property charged: First mortgage debentures of the Havana Telephone Co. (acquired in exchange for debentures of this issue), said debentures being deposited with Martin's Bank, Ltd. No trustees.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—Issue on December 23rd of £1,000 debentures, part of series created April 8th, 1908, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,500.

Omega Electric Lamp Co., Ltd (100,678).—Particulars of £1,500 debentures created December 18th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Harrow Electric Light and Power Co., Ltd. (44,529).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated 1900 and charges dated 1898 and 1900, securing £16,825.

City of Oxford Electric Tramways, Ltd. (91,106).—Debenture dated December 14th, 1908, to secure £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. Holders: Lloyd's Bank, Ltd.

CITY NOTES.

London United Tramways, Ltd.

A NOTICE has been issued by the secretary to the holders of 5 per cent. cumulative preference shares in this company in the following terms:—

"The directors have resolved that a payment on account of the 5 per cent. cumulative preference dividend shall be made at the rate of 2½ per cent. per annum for the half-year ending the 31st inst. (making 3¾ per cent. for the year), and a warrant in respect of your holding is herewith enclosed. The directors desire me to state that, although there has been an increase in the total traffic receipts, yet, having regard to the additional route mileage being worked, the receipts have not shown that expansion which they had anticipated. Moreover, the company has had to encounter severe competition, which has seriously interfered with the growth of traffic on the main routes. When the accounts are published to the shareholders in February next, it will be seen that the directors have exercised every possible care in keeping the working expenses well within bounds, and that the revenue account will doubtless show a balance sufficient to cover the full dividend on the preference shares for the whole year. The directors, however, feel that in view of the necessity for providing funds to meet future renewals, the strengthening of the reserve funds, which they had hoped would have been possible out of increased receipts, should, in the permanent interests of the preference shareholders themselves, be no longer delayed, and that for the present the payments *on account* of preference dividend should be limited to 2½ per cent. per annum. The directors hope the shareholders will realise that in thus adopting a conservative policy, the course now taken is dictated by the desire to maintain the financial soundness of the undertaking."

Topsham Electric Supply Co.

THE third annual meeting of this company was held on 1st inst., in the Town Vestry.

In the absence of Capt. T. J. Holman, MR. C. F. GALE presided. The directors' report stated that "the present year marks a very important step in the progress of the company. Although in existence a little over two years only, it was found at the beginning of the year that the premises occupied as a generating station were much too small. Consequently, it was decided to remove to a larger and a more central building. The work of removal was carried out at a cost of £57, a very moderate sum for the amount of labour involved in transferring the whole of the machinery from one part of the town to another." This had made possible a more economical means of distribution and generation. Although it was a large sum to be borne by the revenue of any one year of a company of their size, the directors considered that by doing so, they were enhancing the value of the shareholders' shares, and they recommended that the whole sum should be charged to current trading account, instead of paying a dividend. During the year there had been 22 additional private customers, as well as extensions by previous ones.

The CHAIRMAN drew attention to the remarkable strides the company had made during its short existence. The income from this (the third) year was, he was glad to note, rather more than three times that of the first year.

The report was adopted.

Thanks were accorded to Mr. H. C. Gould, the manager and secretary, to whom the success of the undertaking was due.

Sunderland District Electric Tramways, Ltd.

THE directors' report for the 12 months ending October 31st, 1908, states that the accounts show a loss on the year's working, after providing for interest on the prior lien bonds and the first and second mortgage debentures of £1,468, bringing the loss to date up to £13,824. The loss on the past year would have been reduced to about £950, had the company not had to deal out of revenue with two items which will not occur again, viz., the loss on Consol deposit released, and the costs of obtaining the abandonment order for the unmade portion of the line, and the transfer of the tramway into the company's name. All these formalities have now been completed, and the property is in the company's name. Compared with last year the traffic receipts at Sunderland show an increase of £1,965, the cost of working to receipts comes out at 66 per cent., as against 75·41 per cent. last year. After consultation with the Committee appointed at the last annual meeting to consider the question of running a service of goods cars, the directors decided not to proceed further with this project; the initial expense of inaugurating a scheme of this sort was found to be much heavier than was anticipated, and its ultimate success problematical. During the year prior lien bonds have been issued at par for cash to the value of £6,000, and a further block of £3,000 have been deposited against a loan of £2,000. Since the close of the financial year, this block of £3,000 has also been issued at par and the loan paid off. It is hoped that not more than £10,000 of the £20,000 prior lien bonds authorised will have to be issued. The track miles open and in use are 14½ miles, the number of cars is 33. Three new cars having been purchased during the year and commenced running in June. The directors have pleasure in reporting that, dating from April last, they have obtained a reduction of rates on the tramway system amounting to about £590 per annum. Taken altogether, the directors are of opinion that the accounts show a considerably improved position, and that the undertaking is gradually pulling round. The improvement would have been greater still had it not been for the unfortunate strike in the shipbuilding industry which began in February and lasted until September 24th. The district served is still feeling its effects.

The fourth annual general meeting was held on Tuesday at the Abercorn Rooms, Great Eastern Hotel, Mr. C. S. Cockburn, presiding.

In moving the adoption of the above report, the CHAIRMAN said they would remember that last year the company was in a very precarious position. This year he was pleased to be able to report that they had paid their debenture interest up to date, cleared off the liabilities and had a considerable amount of cash in hand, so that their credit, which last year was at a very low ebb, was, that day, completely re-established. They had placed their rolling stock and equipment in good order and repair, and consequently were able to reduce the working expenses and other charges. As the shareholders had last year shown their confidence in the board by acceding to their proposals, so during the past year they had endeavoured to show that the confidence was not misplaced. He did not wish to be unduly optimistic, but they could be sure that the company would never again get into the parlous state it was in last year. They had issued £8,500 prior lien bonds, and that item appeared in the balance-sheet for the first time. Sundry creditor were £5,846, as compared with £6,138 last year. They had reduced the loan from the Durham Power Co. from £4,300 to £2,310, out of royalties received from that company. Last year cash in hand at bankers was only £2,800, while this year it was £5,544. The deficiency on the year working was £1,467, as compared with £4,723 last year. That reduction would have been greater only they had written off the sum of £300, representing the difference in the profit on consols, and £213 law charges. All the other items showed a satisfactory state of things. From November, 1907, to October, 1908, the receipts per car-mile were 8·99d., as compared with 7·068d.; operating costs per car-mile, 2·24d., as against 2·154d.; general charges, 1·12d., last year, 1·034d. Their net revenue this year was 2·954d., as against 1·434d, last year. That figure compared with an average of 22 similar companies of 2·960d., so they were getting their revenue up to what they might reasonably expect. The car-mileage run was 694,336, as against 758,532, and they carried 3,930,868 passengers, as compared with 3,741,096 in 1907. They would remember that last year he told them they were trying to make a feature of carrying goods. He was sorry to say, however, that they found that to carry that project out at a profit would entail a very large outlay, and they had, therefore, abandoned the scheme. As to the future, he thought that, if the company went on as it had done, they would have sufficient money to meet the three debentures out of revenue, and something over. If that occurred, they would have to deal with the question of the suspense account, the accumulation of arrears of preference dividend, and re-arrangement of capital. The board had a scheme in their mind, but the time had not arrived for bringing it forward.

MR. C. EVES seconded the motion, and the report was adopted without discussion.

London Electrobus Co., Ltd.—The report of this company for the period from July 15th, 1907, to October 15th, 1908, which, according to the *Financial Times*, was presented at the meeting held on Monday last week, stated that while the directors regretted the necessity of issuing debentures they reminded shareholders that they had had many difficulties to surmount in introducing and fostering a new enterprise which had been considerably retarded owing to the great opposition it encountered at the beginning. "Notwithstanding this, the company has shown, by certified figures, that the electrobus is a commercial success, each 'bus in commission earning an operating profit of £448 per annum. The company, the directors state, is the only motor-bus undertaking that has published details of its operating expenses and earnings. Experience has proved to the directors the profitable earning power of the electrobus, and, with the necessary working capital to augment the fleet of 'buses, there is no reason why in the near future the shares should not be on the dividend list. It must be remembered that the heavy establishment expenses consequent upon the introduction of a new enterprise will not recur. The electrobus is now established, and is acknowledged to be superior to the petrol 'bus, both by the public and the authorities."

Electric Construction Co., Ltd.—It is announced that the directors have resolved to pay on January 15th the dividend on the 7 per cent. preference shares for the year ended May 31st, 1908.

MARKET QUOTATIONS.

Wednesday, January 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	23/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£23 10	..
a ,, White Sugar	per ton	£23	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£30	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	90/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b ,, Wire, in ton lots ..	per ton	£112	..
b ,, Sheet, in ton lots ..	per ton	£120	..
p Babbitt's metal ingots	per ton	£50 to £135	dec.
c Brass (rolled metal 5" to 15") basis	per lb.	7¼d.	..
c ,, Tube (brazed)	per lb.	9d.	..
c ,, ,, (solid drawn)	per lb.	8d.	..
c ,, Wire, basis	per lb.	6¾d.	..
c Copper Tubes (brazed)	per lb.	9¾d.	..
c ,, ,, (solid drawn) ..	per lb.	9¼d	..
g Copper Bars (best selected) ..	per ton	£77	£1 inc.
g Copper Sheet	per ton	£77	£1 inc.
g ,, Rod	per ton	£77	£1 inc.
c ,, (Electrolytic) Bars ..	per ton	£67 10	£1 inc.
c ,, ,, Sheets ..	per ton	£74	£1 inc.
c ,, ,, Rod ..	per ton	£72	£1 inc.
c ,, ,, H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb.	3/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	5/2	1d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	49/1	7d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	per ton	£14	..
g Lead, English Ingot	per ton	£13 15 0	2s. 6d. inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 10	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/0½ to 1/2	..
p ,, rolled bars & rods	per lb.	1/2½ to 1/6½	..
p ,, ,, strip & sheet	per lb.	1/3 to 1/6	..
o Platinum	per oz.	84/-	..
c Silicium Bronze Wire	per lb.	9½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	per ton	£131 to £132	10s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh's (Vieille Montagne bnd.)	per ton	£24 15	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notice.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—£126,500 5 per cent. mortgages of £100 each, Nos. 1 to 1,265 (registered).

Mexican Light and Power Co., Ltd.—The directors announce a dividend of $1½ per share for the past quarter, being at the rate of 6 per cent. per annum.

According to the financial Press, at the special meeting of this company held in Montreal on Wednesday last week, no decision was arrived at concerning the lease of the undertaking to the Tramways Co.

STOCKS AND SHARES.

Tuesday Afternoon.

Business began the New Year in the Stock Exchange with a tolerable amount of activity. A prolonged spell of really cheap money is thought to be nearing inauguration, and the usual cheerfulness which is incident to the commencement of another twelvemonth led to rather more lively dealings. The better state of affairs, however, did not last for long, and the earlier rises were, in many cases, lost within a day or two of their appearing.

New issues are meeting with a good deal of success, and there appears to be a healthy public appetite for good stock when offered on tempting terms.

At the end of December there are hundreds of quotations officially marked *ex* dividend, and a glance at the prices on the following pages will show that electricity descriptions of all kinds—but more especially pre-ordinary issues—are now *ex* dividend. In a fair number of instances part of the deduction has already been recovered, while in a few the *ex* dividend price remained the same as that which was quoted before the amount came off. For example, Amazon Telegraph 5 per cent. Debentures are still 95½, though *ex* the half-yearly 2½ per cent. Globe Ordinary is another, and Pacific Debentures are similarly situated.

It was unkind of the market to quote London United Tramways Preference as *ex* 5s. last week, inasmuch as it had to be corrected subsequently to half-a-crown. The company has declared a dividend at the rate of 2½ per cent. on its Preference, making 3¾ per cent. for the year, and the directors express a pious hope that the deficit may be paid off when the books are made up. The interest, of course, is cumulative, and the price of the shares, of the nominal value of £10 each, fully paid, has declined to 4, *ex* the 2s. 6d. dividend.

An evening contemporary mentioned the announcement on an orange contents bill as a "financial surprise." There must surely have been a change in the City Editorship of that journal of late years. We repeat, once more, that the London United Tramways is gravely at fault in paying-out a penny piece of Preference dividend while the depreciation and reserve funds clamour for attention. This is no time of day to take such matters in hand; it should have been done years ago, when the concern was enjoying some measure of prosperity and could have less ill afforded to devote adequate sums to these purposes.

City and South London Ordinary stock, forced down to 26 the other day, the lowest price of last year, has rallied to 29, and there are buyers about who have been attracted by the drop in the price. Central Londons have not moved, but both Metropolitans and Districts advanced upon the hope that the lines will benefit from the latest specimens of weather samples. Bakerloo 4 per cent. Debenture, carrying £2 dividend payable this month, has risen to 96, while Piccadilly Debenture is better at 92 *ex* dividend, and is being steadily absorbed. Charing Cross Debenture at 86 is also *ex* the half-year's interest.

Electricity supply shares are quiet, without much movement in either direction. A rise of ½ in City Lights is offset by declines of the like amount in Metropolitans and Westminsters. Over a dozen issues are quoted *ex* dividend. Mexican Light and Power Common shares are 10s. better on the dividend declaration of 1½ per cent., and the Common stock of the Mexico Tramways at 135 is easier. Rio shares, however, jumped 3¼ to 83¼, though Sao Paulo Trams at 157 *ex* are easier. Some of the other foreign tramways varieties have been shorn of their dividends, and allowing for this, the net fluctuation on the week is inconsiderable.

Telegraph and telephone stocks and shares are steady, with more gambling in Anglo-American Deferred as one of the leading features. The market is beginning to work up more than a little interest over the annual dividend declaration on the Deferred stock Eastern Telegraph stock is unchanged, but "China" shares gained 5s. None of the British cable companies are affected, directly, at all events, by the awful disasters in Italy and Sicily, but the lines are very busily engaged with the news traffic. Telegraph Construction shares firmed up.

National Telephone Deferred and the two Debenture stocks are a trifle better. United River Plate Telephone Ordinary is nominally lower, though actually the movement does not amount to much. Manufacturing shares are very tame. Brush Preference are said to have changed hands at 6d., but those who wanted to buy shares at that price experienced difficulty in finding sellers.

Constantinople Tramways Co.—At their meeting held 23rd ult., a resolution was approved for increasing the capital by £T352,340, by the creation of 17,617 shares of £T20, £T5 paid up, to range with the existing shares, and for the issue of £T400,000 debentures.

SHARE LIST OF ELECTRICAL COMPANIES,

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Dec. 29th.	Closing Quotations Jan. 5th.	Business done week ended Jan. 5th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅜ — 2⅞	2⅜ — 2⅞	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	5 %	5 %	5 %	..	94 — 97	94 — 97 xd	..	..	..	5 3 1
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	..	131 —134	129 —132 xd	..	..	..	6 1 3
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	..	95 — 97	93 — 95 xd	..	..	..	4 4 3
598,180	Anglo-American Telegraph	Stock	8½%	8⅓%	8⅓%	..	56 — 59	56 — 59	..	..	..	5 18 8
3,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	..	97 — 99	95 — 98	98⅛	97	—1	6 2 5
3,200,910	Do. do. do. Deferred	Stock	⅛	1⅜	1 %	..	15⅛ — 15⅝	14⅞ — 15⅛	15⅛	14⅞	— ⅛	6 11 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	..	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8¼	8 — 8¼	..	..	..	4 14 1
2,883,876	Commercial Cable Stng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	87 — 89	85 — 87 xd	86⅛	86	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7½ — 8½	7⅞ — 8½	..	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	16½ — 17½	16⅞ — 17⅞	..	..	..	5 14 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8 — 8¼	8 — 8¼	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	101 —104	99 —102 xd	..	..	..	8 16 6
60,710	Direct United States Cable	20	4½%	4⅝%	4⅝%	..	12⅞ — 13⅜	12⅞ — 13⅜	..	..	..	6 7 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	102 —104	100 —102 xd	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	128 —133	128 —131	128½	128	—1	5 6 10
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	..	82 — 85	84 — 87	84½	83½	+2	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	..	103½—105½	103½—105½	104	..	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	11⅝ — 12⅛	11⅞ — 12⅛	12⅛	11⅞	+ ⅛	5 13 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	101 —103	101 —103	102⅜	..	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..	3 18 5
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10 — 10½	10 — 10½	10⅝	10	..	5 14 8
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13½ — 13⅝	12¾ — 13⅛	13⅛	13⅛	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	..	30 — 32	30 — 32	31½	..	..	6 5 0
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	..	102 —104	100 —102 xd	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	52 — 55	52 — 55	..	..	..	6 16 4
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	..	74 — 78	74 — 78	..	..	..	5 2 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	71 — 74	71 — 74	..	..	..	5 12 8
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	11/10½	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	¾ — 1	¾ — 1	18/-	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞ — ¾	⅞ — ¾	..	..	..	5 8 11
2,235,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	..	108½—110½	108¾—110½	109¼	108½	..	5 8 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	..	116 —118½	117 —119	118	116½	..	5 0 10
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	..	10½ — 11½	10½ — 11½	..	..	..	5 4 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	..	10⅜ — 11½	10⅜ — 11½	..	..	..	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	..	5 7/16 — 5 9/16	5 7/16 — 5 9/16	5 7/16	5 5/16	..	4 7 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	..	98 —100	97 — 99 xd	97	..	..	3 10 11
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	101 —103	100 —102 xd	100½	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 16 2
50,000	Do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	..	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	..	90 — 92	88 — 90 xd	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	..	101 —103	100 —102 xd	..	..	..	3 18 5
11,839	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	..	100½—102½	99 —101 xd	..	..	..	4 9 1
3,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	127 —130	127 —130	128	127½	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅝ — 7⅛	6⅝ — 6⅞ xd	6⅝	..	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5⅜	4⅝ — 5⅛ xd	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1¼ — ..	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	101 —103	99 —101 xd	..	..	..	3 19 3
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	12½ — 13	12⅝ — 13⅛ xd	13	12⅞	..	5 6 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	102 —104	101 —103	101⅝	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	11/8	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	5 %	6 %	6 %	..	7⅞ — 8¼	7⅞ — 8¼	..	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅞ — 8¼	7⅞ — 8¼	..	..	..	2 14 1
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	..	102 —104	100 —102 xd	100	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	..	9⅛ — 9½	9 — 9⅛xd	9 3/16	..	..	4 17 4
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5⅛%	5⅛%	5⅝%	..	6 5/16 — 6 7/16	6⅛ — 6⅜xd	..	..	..	4 10 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	..	143 —148	140 —145 xd	..	..	..	4 5 9
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	..	102 —105	101 —103 xd	..	..	..	4 17 1
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	..	3¾ — 4	3¾ — 4	80/-	..	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	15 11 2
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	3 — 3⅛	3 — 3⅛	66/3	63/9	..	10 0 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	3⅝ — 4⅛	3⅝ — 4⅛	81/3	..	..	7 1 2
12,327	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	..	3¾ — 4⅛	3¾ — 4⅛	..	..	..	4 8 11
48,473	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	105 —108	105 —108	..	..	..	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	..	98¼—100½	98¼—100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	8 %	..	135 —138	135 —138	135½	..	..	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	6 %	6 %	..	116 —120	116 —120	..	..	..	4 11 4
800,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	..	107½—109½	107½—109½	109½	..	..	4 11 9
333,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	..	102 —104	102 —104	..	..	..	10 15 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	..	103 —106	103 —106	..	..	..	4 4 11
188,301	British Electric Traction	10	8 %	Nil	Nil	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	20/-	18/9	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	..	3¾ — 4	3¾ — 4	..	..	..	7 10 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	92 — 97	92 — 97	93½	92½	..	5 3
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	73 — 75	73 — 75	..	..	..	6 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	..	6¾ — 7	6¾ — 7	..	..	..	7 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6⅝ — 6¾	6¾ — 6¾	..	..	..	4 12
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	..	105 —108	103 —106 xd	104½	..	..	4 4 11
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	43 — 48	41 — 46	..	..	—2	8 14 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	..	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	..	..	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	65 — 70	65 — 70	..	..	..	6 8 7
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	49 — 53	46 — 50 xd	..	..	..	9 0 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	..	4½ — 5	4½ — 5	97/6	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	..	4½ — 5⅛	4⅝ — 5⅛xd	..	..	..	4 17 7
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	..	103 —106	101 —104	101½	..	—2	4 6 7
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9 — 10	9 — 10	..	..	..	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	108 —110	106 —108 xd	..	..	..	4 3 4
491,222	Cape E Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1¼ — 1⅜	1⅜ — 1⅜	31/9	31/-	..	7 10 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —107	103 —107	..	..	..	4 6 11
1,898,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	8 %	..	64 — 66	64 — 66	65⅛	64	..	4 10 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	..	84 — 86	84 — 86	..	..	..	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	9 %	..	50 — 52	50 — 52	50	..	..	8 16 11
1,480,000	City and South London Railway	Stock	1¾%	2¼%	2½%	..	25½ — 26½	25½ — 26½	26½	26¼	+3	7 4 1

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Dec. 29th.	Closing Quotations Jan. 5th.	Business done week ended Jan. 5th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	£	2½%	5 %	5 %	..	1 5/16 — 1½	1 5/16 — 1½	..	..	..	10 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	98 —101	96 — 99 xd	..	..	..	5 1 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	..	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	7 2 10
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 1 1
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	101 —104	99 —102 xd	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6%	6 %	6¼%	..	11½— 12⅝	11½— 12½	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	4½%	..	7/16 — 11/16	7/16 — 11/16	..	..	..	16 15 3
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	4½%	..	1½ — 2⅛	1½ — 2⅛	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	76 — 79	75 — 78 xd	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	£	Nil	Nil	Nil	..	3/8 — 5/8	3/8 — 5/8	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390.	£	7 %	7 %	7 %	..	1 — 1⅛	1 — 1⅛	..	..	..	9 6 8
26,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7¼ — 7⅝	7 — 7⅜ xd	30/7½	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	..	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	..	1/4 — 3/8	1/4 — 3/8	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	£	15%	15 %	15%	..	11½ — 12⅝	11½ — 12⅝	12 5/16	12	..	6 0 0
40,000	Do. do. 4½ % Pref.	£	4½%	4½%	4½%	..	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	16⅝ — 17⅝	16 — 16⅞ xd	16	..	..	8 1 7
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	¾%	..	1 — 1⅛	1 — 1⅛	..	..	..	5 19 5
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	..	4 — 4½	4 — 4½	..	..	..	11 2 2
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	..	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 8 11
999,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	..	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	..	4½ — 5	3½ — 4½ xd	86/3	85/-	..	11 2 2
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	..	68 — 72	66 — 70	68½	..	—2	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	¾%	..	35½ — 36½	36 — 37	36 7/8	36	+ ½	1 7 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	..	68 — 70	68 — 70	69	..	..	3 18 7
3,285,000	Do. District	100	Nil	Nil	Nil	..	13½ — 14	13½ — 14	14 7/16	13⅜	..	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	7/16 — 9/16	7/16 — 9/16	15/6	..	..	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	..	93 — 96	91 — 94 xd	92⅝	92	..	4 15 9
245,500	Potteries E. Tro.	1	4 %	4 %	4 %	..	1/16 — 1/8	1/16 — 1/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	1/16 — 1/8	1/16 — 1/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	90 — 93	90 — 93	..	..	..	4 14 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	..	30½ — 32½	31 — 33	32⅜	..	+ ½	6 12 7
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	..	101½ —103½	99 —102 xd	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	93½ — 94½	95 — 96	95⅜	94½	+1½	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	..	74 — 76	73 — 75 xd	..	..	..	..
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	21 — 23	22 — 24	..	..	+1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	10 %	..	5/8 — 7/8	5/8 — 7/8	..	..	..	10 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	..	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	..	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	£	5½%	5½%	5½%	..	4½ — 5	4½ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	..	94 — 98	94 — 98	..	..	..	4 10 0
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	£	10 %	10%	10 %	..	8½ — 9	8½ — 9	8½	..	..	5 12 8
9,725	Do. do. 7 % Cum. Pref.	£	7 %	7 %	7 %	..	8 — 8½	8 — 8½	..	..	..	4 2 4
386,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	..	99 —101	98 — 101	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	£	5 %	5 %	5 %	..	4⅜ — 4⅞	4⅜ — 4⅞	92/6	90/-	..	5 2 7
80,000	Do. do. do. 4½ % Cum. Pref.	£	4½%	4½%	4½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	£	4½%	4½%	4½%	..	3¾ — 4⅛	3¾ — 4⅛	..	..	..	5 16 2
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	97½ — 99½	96 — 98 xd	..	..	—1½	4 1 8
49,486	Chelsea Electricity Supply, Ord.	£	6 %	4½%	4½%	..	3⅜ — 4¼	3⅜ — 4¼	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	..	103 —106	102 —105 xd	104	103½	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	..	10½ — 10⅝	10⅜ — 10⅝	10⅝	10½	+ ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	12¾ — 13	12¾ — 13	12 13/16	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	128 —125	121 —123 xd	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	101 —103	99 —101 xd	..	..	..	4 9 1
50,000	County of Durham Electrical Power, Ord.	£	4 %	4 %	2 %	..	2½ — 3	2½ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	£	5 %	5 %	5 %	..	3½ — 4	3½ — 4	..	..	..	6 5 0
200,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	99 —101	96 — 98 xd	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	..	8⅞ — 9⅜	8⅞ — 9⅜	9	..	..	5 7 9
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅜ — 11⅛	10⅜ — 11⅛	11 1/16	11	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	..	107 —110	105 —108 xd	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	£	4 %	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	£	6 %	3 %	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	62 — 65	62 — 65	..	..	..	6 18 6
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	83 — 85	83 — 85	83¾	..	..	..
10,000	Folkestone, 1 to 10,000	£	5½%	5½%	5½%	..	4⅝ — 5¼	4⅝ — 5¼	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	£	5 %	5 %	5 %	..	5 — 5⅜	5 — 5⅜	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	97 — 100	97 —100	97¾	..	..	4 10 8
15,000	Hove, 1 to 15,000	£	9 %	9 %	8½%	..	6⅝ — 6⅞	6⅝ — 6⅞	..	..	..	6 8 4
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	95½ — 96½	94 — 95 xd	94½	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	£	10 %	10 %	10 %	..	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	£	4 %	4 %	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 6 8
70,000	Do. do. do 6 % Pref.	£	6 %	6 %	6 %	..	4⅞ — 5⅛	4⅞ — 5¼	5⅛	5	— ⅛	5 14 3
374,295	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	..	89 — 93	89 — 93	..	..	..	4 16 9
900,000	Metropolitan Electric Supply, 1 to 100,000	£	10 %	6 %	6½%	..	5½ — 5⅝	5 — 5½	5½	..	..	5 15 7
76,121	Do. 4½ % Cum. Pref. 1—71,106	£	4½%	4½%	4½%	..	4⅝ — 5¼	4⅝ — 5¼xd	..	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	..	107 —110	105 —108 xd	..	..	..	4 3 4
248,000	Do. 5% Mort. Deben. Stock Redeem.	Stock	5%	5%	5%	..	86 — 89	85 — 88 xd	86¾	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	..	87⅞ — 88⅞	85½ — 86½xd	88	..	..	5 15 11
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	75⅞ — 76⅞	76 — 77	77	75	+ ½	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	105⅝ —107⅛	105½ —107½	107	106½	..	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	89⅝ — 90⅝	89½ — 90½	90⅝	90	..	..
.50,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	95 — 98	93 — 96 xd	..	..	..	4 13 9
87,500	Newcastle-on-Tyne, 1 to 87,500	£	8 %	8 %	8 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	£	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	..	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	£	7 %	7 %	7 %	..	5⅝ — 6⅜	5⅝ — 6⅜	..	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	..	95 — 98	96 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	..	..	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	20/6	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	..	..	100 — 103	98 —101	..	..	— 2	4 19 0
40,000	St. James' and Pall Mall Electric Light, Ord.	£	12½%	10 %	10 %	..	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	5 9
20,000	Do. do. 7 % Pref. 20,081 to 40,080	£	7 %	7 %	7 %	..	7 — 7⅛	7 — 7⅛	..	..	..	4 18 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	..	87 — 91	86 — 90 xd	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	£	4 %	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	68 — 72	68 — 72	..	..	..	5 11 1
66,000	South London Electricity Supply, Ord.	£	4 %	3 %	4 %	..	2⅝ — 3	2⅝ — 3	56/3	53/9	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	£	2½%	2½%	2½%	..	3/16 — 5/16	3/16 — 5/16	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	£	7 %	7 %	7 %	..	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	£	5 %	5 %	5 %	..	7/8 — 1	7/8 — 1	12/6	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	£	5 %	5 %	5 %	..	1⅝ — 2	1⅝ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	31/32 — 1 1/32	31/32 — 1 1/32	..	..	..	..
110,000	Westminster Electric Supply, Ord.	£	13 %	19 %	10 %	..	7⅞ — 8¼	7⅞ — 8¼	8⅜	8 7/16	— ⅛	5 14 3
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	£	5 %	4½%	4½%	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

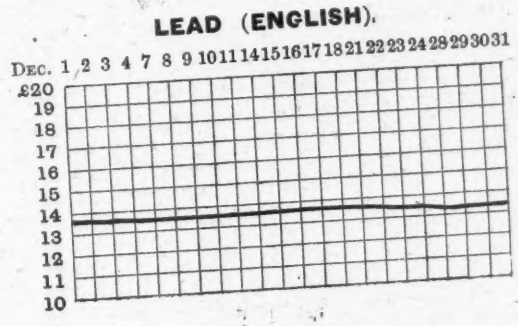
Bank rate of Discount 2½ per cent., May 28th, 1908.

METAL MARKET.

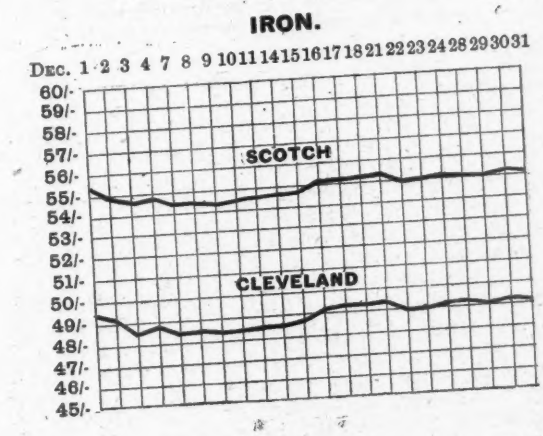
Fluctuations in December.

SPELTER (G.O.B's.).

LEAD (ENGLISH).



IRON.



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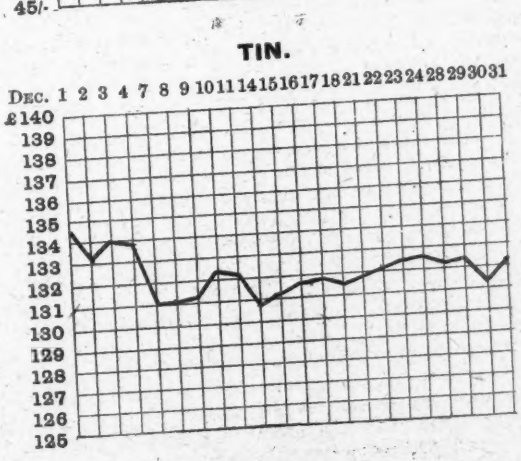
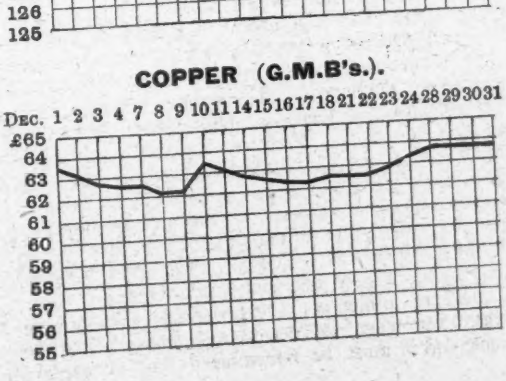


COPPER (G.M.B's.).



THE CRAZE FOR CHEAP WIRING.

By S. G. CASTLE RUSSELL, M.I.E.E.

Once again the cheap wiring question is with us; many times during the last 20 years have efforts been made to upset the existing standard of installation work in this country, but so far without success.

The raising of the question at the present time is due to the suburban supply engineers, who see in the wholesale adoption of the metallic-filament lamp, a menace to their profits.

I am among those, however, who consider that the station engineer has merely to sit tight, and matters will adjust themselves in the long run, without the adoption of questionable methods. The new lamp will greatly increase the popularity of electric lighting, and lead to largely increased loads.

The metallic lamp compares with the gas mantle, as the old carbon lamp never could, and never can do, from an illuminating point of view, and it is now possible to honestly state that electric lighting compares favourably with incandescent gas lighting, both on the score of efficiency and economy. The metallic lamp will do for the electric lighting industry what the gas mantle did for the gas industry, and allow favourable competition with a dangerous rival. I consider, therefore, that the waiting game is the one to play, and that any attempt to force matters by riding roughshod over powerful interests will do more harm than good, and create dissension in an otherwise united camp.

There is, however, a section that takes the view that the best way to counteract falling revenue is to encourage the wholesale addition of lamps by cheapening the cost of installation to such an extent, that the small class of householder can be induced to adopt electric lighting; but the feeling is not a unanimous one, many being of opinion that this class of consumer will never be a remunerative one, owing to small consumption and the high price of lamps.

The view taken by this section is a selfish one, and ignores certain important interests, and in consequence a situation may be created, which, in the opinion of those qualified to judge, will not be good for the industry at large.

It is proposed that the supply station should run an installation department, and carry out wiring on the cheapest possible lines. Hitherto, the ordinary contractor has done the installing in most districts, acting practically as an unpaid agent for the station, and cheerfully bearing all the canvassing and advertising expenses. The contractor, then, is to be sacrificed in the interests of the supply station.

Already there are certain municipal stations which run wiring departments, but whether this form of trading will put the undertaking on a paying basis is an open question, as the canvassing and advertising expenses must be enormous. There are many instances of supply authorities who have, in the past, found it advisable to discontinue their wiring departments.

That the interests of the public and the fire offices will also be affected, there can be little doubt. These interests are largely mutual, owing to the fact that a fire is equally disastrous to both; in the case of the assured, a fire means loss of business, which may never be recovered, and frequently increased rates of premium. As an instance, take a large block of buildings which for many years has been highly rated, say at 21s. per cent., on account of its surroundings, and the hazardous nature of certain business carried on by tenants. Owing to the non-occurrence of fires and the carrying out of certain improvements in the nature of structural alterations, the fire offices agree to reduce the rate by 50 per cent. The proprietor insures for, say, £100,000, and the tenants, collectively, insure for anything over £500,000 for valuable stocks, &c. As will be seen, the saving in the premiums is very considerable to all parties, but it is highly important that no fire should occur, as the fire offices would take alarm, and at once revert to the original premium which, in the first place, was considered the minimum. Now, granted that we are going to have cheap (and possibly nasty) systems of wiring, this will certainly mean an added fire risk, for, in a building of this description, it is impossible to know what all the tenants are

doing, and the proprietor will have his interests jeopardised by the fixing of, say, very inferior flexible cord in such places as show windows, &c., without his knowledge or the sanction of the fire offices. The position of the proprietor is such that he can insist upon electric light wiring being on the most approved system as regards fire risk, and he is backed up by the requisitions of the fire offices. Of course, if he has knowledge of any inferior wiring, he can interfere, but pending this knowledge, a disaster may happen. The irresponsible recommendation of flexible cord installations by the supply stations will influence the tenant, who will have no conception that he is doing anything that will jeopardise his landlord's interests.

I have recently had experience of a concrete example of the foregoing proposition, and can therefore speak with authority.

Let us now consider the position of the fire offices, with regard to which there is a great deal of misconception.

At the present time the protection of that portion of the public that lives in premises that do not come under the Factory Act, or under the Board of Trade Regulations, is largely in the hands of the fire offices, whose representatives are among the few who are allowed business access to the "Englishman's Castle." It is generally understood that the proper thing to do when an electric light installation is adopted, is to request the fire office concerned to make an inspection, and furnish a report. The assured is not satisfied with the statement that his policy will not be affected, and that the installation will be freely allowed; he frequently insists upon knowing in what points, if any, the work differs from the office rules, to which he has required his contractor to conform. An inspector is often, therefore, required to go beyond what his office desires, and has unwillingly to accept a responsibility that is forced upon him, in order to meet the wishes of a valued client. Should any fire happen after such an inspection has been made, then the office will hear of it, very much to its detriment. I have known of many instances of insurance being removed from a particular office, because an inefficient inspection has been made. Great reliance is placed on the fire office inspection, as it is recognised that it is an independent one, and nearly all the fire offices now retain competent inspectors—a very different state of affairs to that in evidence some years ago, when the brunt of inspection work fell upon two or three offices only, the remainder being content to "follow." The original feeling that electric light wiring would standardise itself, as in the case of gas lighting, and inspections become unnecessary, has never been realised, and no surprise can be expressed in view of the fires caused by defective wiring, and the many attempts to introduce flimsy and insecure systems of installation.

The feeling of public confidence in fire offices will never become eradicated, owing to mutual interests and consequent friendly relations, and the fire companies are actively fostering this feeling, some going so far as to advertise free expert advice. It is quite a common thing for an assured to refer to his fire office, as to the capabilities of the firm of contractors he proposes to employ.

Fire Office Rules are, by those qualified to know, considered to be absolutely necessary, just as are the Home Office and Board of Trade Regulations. The justification of the latter is borne out by the recent publication of statistics showing the number of accidents in America: 35,000 workmen killed and 2,000,000 injured! Our cousins are now to consider the enforcing of British methods of protecting workmen, just as they have had to consider the adoption of British wiring practice and rules. It is not so very long ago that a serious proposition was made in a technical paper, that America, in consequence of the numerous electric fires, should retain the services of our old friend, Mr. Musgrave Heaphy, to revise the American wiring rules. No one will begrudge praiseworthy mention of Mr. Heaphy, who is largely responsible for the present high standard of wiring work in this country.

Before leaving the subject of Fire Office inspections, I would like to draw attention to a query in the recent issue of the *Gas Journal*, viz., "Where is the Phœnix Gas Engineer?" &c. Your contemporary is assuming too much; all the Fire Offices have competent gas inspectors among their staffs of surveyors, who frequently make requirements directed towards the prevention of fires. This has always been the case, although their work has been simplified by the adoption of a standard and substantial system of installation, notwithstanding attempts from time to time to introduce inferior types of piping. Rules for the gas industry have always been in evidence, and strict regulations have recently been drawn up to meet the new conditions of lighting, such as petrol, gas, acetylene, &c. As regards the observance of Fire Office Rules, no one must lose sight of the fact that any attempt to over-ride them without consent may imply a serious responsibility.

I will now consider the position of the contractor, especially of one whose business has been built up by the general excellence and security of his work. He is to be forced, owing to the action of the supply stations, to enter into competition, in many instances, with rate-aided concerns, for the erection of work that will no longer bring him credit and good connections. Under the conditions of "cheap wiring" he will have to fix work that will require constant attention and renewals, and he will have to choose between calling attention to defects, and practically condemning his own work, or letting things slide, and risking his client's interests. His status will be a very different one from what it is now, when he can point with pride to installations erected by himself, over 20 years ago, still running efficiently, and can earn the commendation of the fire offices by his good work. Of course, there will always be a certain amount of good class work to do; there are many wise and businesslike people in the country who will see to this, but such work will become increasingly scarce, when it becomes known that very cheap systems of wiring are permitted. In these days when securities are so low that money cannot be realised without great loss, there is every incentive to false economy. I take the view that under the conditions of cheap wiring, the better class of contractor will become eliminated, and the work largely left in the hands of irresponsible workmen, or plumbers and gas fitters. The almost certain result will be discredit to the industry.

Another interest to be considered is that of the consulting engineer, who, by his steady advocacy of wiring systems in accordance with the fire office rules in the past, is largely responsible for the present standard of work.

Having now discussed the question of the interests likely to be affected by the adoption of cheap and presumably insecure systems of wiring, we will turn our attention to the particular systems recommended, in order to reduce installation expenditure to a mere nothing.

The most favoured at the moment, by the advocates of cheap wiring, is known as the "surface flexible-cord system." It has many disadvantages; the assumption that it will be confined to surface work is not borne out by experience. Owing to its adaptability, it will readily lend itself to the hands of the amateur, who will not hesitate to run it in hidden positions. I have on many occasions found it used in roofs, under floors and carpets, and even under wall paper, and in similar unsuitable positions where it is a source of danger. It is also often twisted round gas pipes, and in consequence there have been numerous instances of gas explosions caused by the failure of the flexible. Another serious drawback to the use of flexible is the ease with which it can be destroyed by mischievous children and dogs, and this often happens with alarming results.

Imagine the condition of an installation of this character after two years' use, taking into consideration the quality of flexible cord that is now in far too common use, even for pendant lamps. It is quite an exception to find C.M.A. flexible cord installed on premises, except where the installation has been erected under supervision or a high-class firm of contractors employed. The common practice is to use very thin flexible for pendants, and a rather thicker quality for portable lamps, &c. This stuff has no lasting qualities, is largely foreign made, and when the rubber has perished, which it soon does, grave risk is run. It is not desirable to contemplate what will happen if this type of flexible is to become in general use, which will be the case if certain people have their way. Flexible cord is at the present moment far too largely used from a safety point of view. A great deal of difficulty is experienced in obtaining its removal, even when its defective condition is glaringly apparent, and it must be remembered that no supervision

will be exercised after the first inspection by the Fire Office, and the question of renewal will be almost wholly in the hands of the consumer or the small wiring contractor who first fixed the wire. In the early days of electric lighting the use of flexible cord was confined to pendant lamps. Its present more general use was never contemplated.

I am personally responsible with regard to the upkeep of a very considerable quantity of flexible cord used in several large institutions with which I am professionally connected, and I find it a constant source of anxiety. Failures occur for which there is no apparent reason, and it is quite impossible to rely on even the best makes of wire. One large consignment failed as a whole after two years' use, and had to be replaced. The only reliable test of flexible cord is that of use under working conditions. Mere laboratory tests are useless, as is well known, as proper conditions cannot be obtained.

In the institutions I have referred to, I have no difficulty in inducing tenants to renew the flexibles, when necessary, as there are so many convincing instances of burn-outs.

The use of flexible cord in show windows of shops, is a source of constant anxiety to the insurance companies, and claims for fire damage to gloves, handkerchiefs, and similar articles, are not uncommon.

I am quite convinced that if the system of wiring by flexible cord is allowed to be carried out in this country to a large extent, fires will greatly increase. Such has been the undoubted experience in America, where under the latest rules the use of flexible cord is in certain risks wholly prohibited, and a warning note is inserted in the Book of Rules against its use.

The great number of fires reported from America and the Continent are largely due to the ill-advised use of flexible conductors. Similar fires are bound to result in this country from the indiscriminate use of flexible where the climatic conditions are less favourable, and the pressures in use higher. I do not wish to pose as an alarmist, and I am too familiar with fires to be nervous, but I feel strongly that the adoption of wiring methods here, which have been discarded as unsafe in other countries, will have a bad result; neither can I agree that our past methods are wrong and unnecessarily safe.

That I am not alone in this view is evident by the communications I have received on the subject of flexible cord wiring from several very prominent supply engineers. One informs me that such wiring is absolutely impossible in his district, owing to the system of annual decorations, and from an æsthetic point of view. Another asks, very pertinently, what will be the position of the supply company in those towns where fire inquests are to be held, when the jury decide that a fire was due to the electric wiring. We know the view taken by the Coroner in the City of London, and the Corporation not very long ago issued circulars to electric consumers, warning them of the necessity of overhauling their installations, and pointing out the danger of fire.

So much for the flexible cord system; let us hope that it will die the natural death usual to inefficient things.

Another system that has been proposed for use is the twin lead-covered one. Here the economy is more apparent than real, as evidenced by the failure of certain firms who made the system a speciality, to make it pay; one of these firms reverted to wood casing, as being cheaper and more reliable. There is also a great difference of technical opinion as regards this system, many holding the view that the jointing and other difficulties are insuperable. My own experience has been an unfavourable one; many of the inefficient installations that I have had to replace were erected originally with lead-covered wires.

A system of substantially insulated conductors, run on insulators, has also been suggested, but although it has certain points in its favour, it is unsightly, and not capable of general application, and, indeed, in certain buildings, would be unsafe. It is only permissible in those premises where it is under constant observation. One of the most disastrous fires due to electric fusion was caused by a falling wire, which ignited inflammable goods beneath it. There is also the probability of goods being hung on the wires, and of mechanical injury.

By far the majority of the trade pin their faith to a wood casing system as the cheapest, consistent with safety and permanency. Certainly this system has stood the time test, and is freely passed by the Fire Offices, who only reject it where the local conditions (such as damp, &c.) are unfavourable. In this instance a judicious partial use of steel barrel often overcomes the difficulty.

There is not the slightest doubt that the electric light is the safest of all illuminants, when properly installed, and this, I believe, is the general opinion of the Fire Offices. This is a great and valuable asset to the industry, in view of the fight that is going to be put up by petrol, gas, &c. Petrol gas plants are more economical and quite as efficient as electric light plants, but have not as yet the same advantages of convenience and security; but there are many keen minds engaged on the elimination of these defects. Already the companies running these plants are securing work and competing with us, and will soon become serious rivals. Let us not, therefore, give away any of our advantages by introducing questionable economies.

As regards the fires that have been shown to have been caused by electricity in this country, almost the whole of them have occurred through the use of inferior material, want of sufficient protection to wires and apparatus, scamped work, or appalling ignorance on the part of workmen. None of them would have claimed attention had proper precautions been taken or ordinary intelligence used. It is here that the value of the Fire Office inspection comes in, and one particular office claims with pride that in no instance where an inspection has been made by its inspector or his staff has an electrical fire occurred of sufficient importance to justify notification or a loss claim. I understand that in future an effort will be made to compile a list of electrically caused fires for the information of Fire Office inspectors.

In consequence of the Workmen's Compensation Act, all the large Fire Offices transact accident insurances, and the inspector has now to consider the bearing of an insecure installation from the point of view of danger to life, thus increasing his responsibilities and that of his office as regards electrical installations.

It must be borne in mind that insurance rates at the present time are very low, owing to the favourable loss ratio generally. This ratio fluctuates, and a time will come when it will be a high one. Rates will be raised, and we must look to it that no excuse is furnished by the electrical industry owing to the prevalence of electrically caused fires.

ON PREPARING PARTICULARS FOR THE TECHNICAL PRESS.

[COMMUNICATED.]

The preparation of suitable information, from which representatives of the technical journals can put together a clear description, is of some importance, particularly in connection with the machinery or apparatus to be seen at exhibitions. In such cases the unfortunate individuals who are entrusted with the work of describing the exhibits for the engineering Press, generally have to prepare their first articles without having had sufficient time to examine all the stands described, with the result that recourse is had to particulars supplied by the exhibitors, or even to the catalogue.

The difficulty of describing the stands in a large exhibition, such as the one held last year in Manchester, is much increased if the exhibits are classified, and there is every indication that classification will be demanded for descriptions of future shows of this nature. This tendency emphasises the need for the preparation of good descriptions of their exhibits by the owners of the various stands concerned, but the work must be done on certain lines if the results are to be of much assistance to the Press.

All manufacturers should, and generally do, consider that their products have advantages over those of other makers, or that the apparatus exhibited may attract attention by its novelty or size, and it is just these points which are of

interest, otherwise the description resolves itself into a mere list of exhibits with a few general particulars.

Many exhibitors do not take the trouble to prepare any information for the Press, and even when such assistance *is* forthcoming, the description often bears strong evidence of having been hurriedly prepared by someone having only a superficial knowledge of the apparatus set forth. Then, again, it is of the utmost importance that such particulars should be available in good time, preferably before the exhibition opens.

It is not for a moment suggested that descriptions of exhibitions should be prepared entirely from particulars supplied by the exhibitors, or that a Press representative should not make as careful an inspection of each stand as time permits, but the information given by the firms exhibiting, will, if properly prepared, be of great assistance in eliminating the need for taking notes on the spot, and in refreshing the memory when the descriptions are written.

Without such assistance, copious notes must be taken, and with every care some points will almost certainly be overlooked; furthermore, the time taken will be much greater than if it were only necessary to verify particulars already written down.

We now come to the preparation of suitable information by exhibitors. This work involves an intimate knowledge of the apparatus to be described, coupled with an extensive acquaintance with similar products by other makers. This latter qualification is the more important of the two, as if competitive developments are not fully known, the writer is liable to make statements about the apparatus described, which appear simply childish to those having a better acquaintance with the subject.

In all cases the designer or inventor of a machine is the best man to go to for information about it, and in almost every instance where a new design or invention has proved successful, the author will be found to possess a full knowledge of competitive practice. Such men are, perhaps, inclined to go too far into technical details, and their explanations are not always as clear as they might be, but the required information would be given, and this tendency should be corrected by those who write the descriptions for publication.

The course suggested involves the employment of trained engineers as the representatives of technical journals at exhibitions, and such a practice has been assumed.

Many firms who are frequently showing at exhibitions do prepare information for the use of Press representatives, and where the particulars are put together on the lines suggested above, the result is often a much better notice than would otherwise have appeared.

Briefly stated, a description of each stand should be made up by the inventors or designers of the apparatus shown (edited, if necessary), and this information should be distributed to the journals likely to be represented, at least a week before the opening of an exhibition.

The Aluminium Price Problem.—Since the dissolution of the aluminium syndicate three months ago, reports have been in circulation of a proposed combination of the French producers of the metal. It appears that the object in view is to arrive at an understanding in regard to prices, without, however, the formation of a sales bureau and financial settlements. The idea is perhaps connected with the circumstance that an upward movement in the market might take place in conjunction with the introduction of aluminium coinage in France, where it is assumed that the Government will distribute the orders for aluminium among the native works. If the total requirements represent about 2,000 tons of metal, the division of the quantity among the various works would only apportion from 300 tons to 500 tons to each, and it is questionable whether such an allotment would materially improve the conditions of individual producers. In any case, it may be concluded that even if the French works come to a price understanding among themselves solely for their home market, the circumstance should cause no illusion in respect of prices in other markets. Indeed, the competition of French producers in certain Continental markets, such as Germany, for instance, and the rivalry of other makers against them, will, it is considered, lead to a fresh contest in the matter of prices, which will continue until producers outside of France arrive at a fresh understanding with the French works, if this be possible, having regard to the origination of new works in the past two years.

SOME SIEMENS INSTALLATIONS OF 1908.

Below we give some interesting particulars relating to some of the more important electrical installations which have been carried out by Messrs. Siemens Bros. Dynamo Works, Ltd., during 1908.

The Cardiff Coal Washeries.

These washeries were erected some time ago on the site near the Queen Alexandra Dock, Cardiff, by Messrs. Franz Megnin & Co., for the Cardiff Washed Coal Co., Messrs. Siemens Bros. Dynamo Works, Ltd., supplying the generating plant and motor and lighting equipments. The power equipment consists of a three-phase standard alternator having an output of 550 K.V.A., 500-525 volts, 50 cycles, at a speed of 125 R.P.M., the steam engine being of the tandem compound single-crank type. No fly-wheel is provided, the necessary fly-wheel effect being obtained by providing sufficient weight in the rotor. The exciter armature is direct-coupled to the engine shaft, the magnet frame being mounted upon a separate sole-plate, and no exciter bearing is provided.

The power section of the main switchboard consists of one generator panel fitted with the necessary apparatus for the control of the generator and exciter, and includes a series regulator for the alternator field, and a shunt regulator for the exciter field, together with two blank panels of the same size, which will be fitted with controlling apparatus when additional generators are installed. Two feeder panels are provided, arranged for three feeder circuits of 400, 200 and 50-ampere capacity respectively. From the 400 and 200-ampere feeder circuits three-core paper-insulated lead-covered cables, fitted with the necessary trifurcating boxes, are taken to distribution boards situated in different positions in the coal washeries, whence the various motor circuits are fed. The 50-ampere feeder circuit supplies current to a 30-B.H.P. three-phase motor, which is direct coupled to a centrifugal pump supplying circulating water to the condensing plant beneath the engine room floor. The starter for this motor is mounted on the switchboard, so that the motor can be controlled without the attendant leaving the switchboard platform. A passage way is provided at the back of the main switchboard, and the ends are enclosed with expanded metal screens. The distribution boards in the washery are also arranged in the same manner, and are fitted with voltmeters, and the necessary switches, fuses, and ammeters for controlling the supply to the following motors:—

One conveyor motor, 12 B.H.P. 1,000 R.P.M., arranged for belt drive; one elevator motor, 25 B.H.P. 1,000 R.P.M., arranged for belt drive; one motor driving elevator and screens, 40 B.H.P. 750 R.P.M., arranged for belt drive; one motor driving elevator, 80 B.H.P. 750 R.P.M., arranged for belt drive; one motor driving drying plant, 80 B.H.P. 750 R.P.M., arranged for belt drive; one motor for washery, 80 B.H.P. 750 R.P.M., arranged for belt drive; one pump motor, 80 B.H.P. 600 R.P.M., fitted with flexible coupling for direct connection to shaft of centrifugal pump; and various other motors.

As the 20-B.H.P. and 12-B.H.P. motors are installed at some distance from the distribution board, these machines are provided with switch boxes (mounted near the motors) containing triple-pole switch, fuses and ammeter, switch fuses being provided for these motor circuits on the distribution boards.

For the lighting, a continuous-current generator has been installed, driven by a belt from the fly-wheel of a separate steam engine and having an output of 75 KW. at 220-230 volts at a speed of 785 R.P.M. This machine supplies current to about 240 16-C.P. incandescent lamps in the washery and office buildings, and also to 24 arc lamps, eight of which are used for lighting the engine room and washery buildings, the remainder being fixed upon poles for lighting the various weigh-bridges, railway sidings, &c.

Two panels are provided on the main switchboard for controlling the lighting equipment, one for the generator and one for controlling the various feeder circuits. The 10-ampere arc lamps are arranged for burning four in series across the 220-volt mains, and are provided with the necessary regulating resistances, &c. A separate circuit is taken to a small distribution board mounted on the first floor of the office building for controlling the office lighting. The generator also supplies current for a 20-B.H.P. motor which is used for driving the machines in the workshop.

Another interesting application of electrical driving is to be found at

Caer Bryn Colliery.

The equipment supplied for this colliery consists of a main switchboard, overhead transmission lines and distributing cables, together with motor equipment, for a continuous-current supply at 500-550 volts.

The switchboard consists of one generator and two feeder panels of enamelled slate, mounted in strip iron frames, which are supported by stays from the wall, and so arranged as to provide a passage way behind the board of the width required by the Home Office Rules. The space behind the board is closed at each end by expanded metal doors. The generator panel is of 75 KW. capacity, and is fitted with maximum and reverse-circuit breaker, single-pole quick-break switch and single-pole fuse, ammeter and voltmeter of the moving-coil type, together with a field breaking switch and resistance and shunt regulator.

The feeder panels are arranged for five circuits of 100 amperes maximum capacity, each being fitted with a double-pole quick-break knife switch, two single-pole fuses, and an ammeter of the moving-coil type.

A leakage indicator consisting of milli-ammeter with two-way switch and resistance, is also fitted on one of the feeder panels. The board is illuminated by incandescent lamps with shades and brackets.

Between the power station and the pit shafts transmission lines of bare copper conductors are provided, these being supported by creosoted timber poles about 32 ft. long; these poles are fitted with oak cross-arms for carrying the porcelain insulators. Lightning arresters of the horn type are provided at each end of each transmission line, and are connected to copper earth-plates.

An earth wire is run the whole length of each transmission line, it being carried on an additional insulator on each pole. It is connected to copper earth-plates near the power house.

The shaft cables consist of two single-core vulcanised bitumen double-wire armoured cable, and the underground cables are of the twin-core type insulated with vulcanised bitumen and single-wire armoured; a cable of a similar type to that used underground is also employed for supplying current to a pump motor in the drift, this cable being mounted on a stand and provided with suitable gear, brake, &c., for raising or lowering the cable to suit the position of the pump in the drift. A double-pole main switch with double-pole enclosed fuses in a watertight cast-iron box is provided at the top of the drift for cutting off the supply of current to the drift pump motor.

The distribution board at the pit bottom is equipped with double-pole switches and fuses in watertight covers for the various motor circuits, the panel being mounted upon a wrought-iron frame.

The motor equipment consists of the following 500-550-volt continuous current machines; an open type, compound-wound motor fitted with belt pulley and slide rails, for driving a fan of the "Waddle" type, about 20 ft. in diameter. It is capable of a continuous output of 30 B.H.P. at a speed of 300 R.P.M.

This set runs continuously day and night at full load. The motor is controlled from a panel fixed to the wall, fitted with single-pole circuit-breaker with overload and no-voltage releases, single-pole quick-break switch, fuse of the porcelain type, and ammeter. The starter is of the liquid type with short-circuiting contacts.

The two pump motors are of the protected type, shunt wound and fitted with commutation poles. They are mounted on slide rails and drive by belt. Each has an output of 18-24 B.H.P., continuously at a speed of from 500-1,000 R.P.M., the speed variation being effected by shunt regulation. The ventilating openings are fitted with special sheet-metal covers to prevent dripping water from entering the machines. The starters are of the customary type with overload and no-voltage releases, and are mounted on panels, together with a double-pole main switch, fuses, shunt regulator, and ammeter, all the apparatus being of the weather-proof type.

Two identical ventilated, shunt-wound motors, fitted with commutation poles, are employed for driving by belt the conveyor and slant pump respectively. Each is capable of developing 10 B.H.P. continuously at a speed varying from 350 to 750 R.P.M. by shunt regulation. They are controlled from panels similarly equipped to those for the pump motors.

The protected compound-wound motor in the washery has an output of 20 B.H.P. at a speed of 750 R.P.M.

All the motor frames and switchgear are earthed by being connected to the earthing wire carried on the poles of the overhead transmission. All switchgear and apparatus conform to the Home Office Rules for mines.

Rotary Kiln Plant at the Cement Works of I. C. Johnson and Co., at Greenhithe-on-Thames.

The generating equipment for this plant consists of three 155-KW. 220-volt two-bearing generators, each mounted on its own bedplate and connnected to the engine by a flexible coupling. The generators are compound-wound and driven at a speed of 175 R.P.M.

The machines are of ample size so as to be able to deal with continuous overloads, and their temperature rise after six hours' run on full load does not exceed 70° F. above the temperature of the atmosphere.

The switchboard is of black enamelled slate, and comprises three generator, one lighting, and two feeder panels. Each of the generator panels is equipped with an overload and an overload and reverse-current circuit-breaker, voltmeters and ammeters, field regulator and equalising switch.

The lighting panel is provided with double-pole switches and fuses for various lighting circuits, while the feeder panels are fitted with circuit-breakers, switches and ammeters. A watt-hour meter for recording the total output of the station is also supplied on one of the feeder panels.

The transmission lines were also supplied and erected by Messrs. Siemens Bros. Dynamo Works, Ltd., and they consist of hard-drawn copper cables suspended by leather slings from steel wires on wooden poles. Lightning arresters and all other usual accessories and fittings are provided.

The motor equipment is as follows:—

The motor driving the grinding plant has an output of 260 B.H.P. at 450 R.P.M. It is controlled from a slate panel with multiple switch starter and circuit-breaker, ammeter, main switch and watt-hour meter.

The motor in the wash mills has an output of 120 B.H.P. at a speed of 350 R.P.M.

The rotary kiln motor has an output of 190 B.H.P. at 350 R.P.M.

The slurry pumping plant motor has an output of 40 B.H.P. at 700 R.P.M.

All these motors are controlled from panels equipped with the usual apparatus and instruments. There are also a number of other small motors driving pumps and miscellaneous small machinery.

The arc lamps and other lighting plant were also supplied and erected by Messrs. Siemens Bros. Dynamo Works, Ltd., who likewise installed the lighting arrangements at the wharf. This work is particularly interesting by reason of the fact that the wharf is at times submerged, so that the wiring had to be very carefully carried out. A series of sockets with watertight covers is provided for removable fixtures, and we understand that no trouble has been experienced.

The Harton Coal Co.

This company obtains electrical energy from the Cleveland and Durham Electric Power Supply Co. Among the motors supplied and put to work this year are the following:—

St. Hilda Colliery.—One three-phase induction motor with bedplate and two pedestal bearings, complete with brush lifting and short-circuiting device, giving an output of 400 B.H.P. at a full-load speed of 295 R.P.M. on 5,500 volts, three-phase, 40 cycles, and direct-coupled by flexible coupling to a colliery ventilating fan. This motor is complete with rotor starter and high-tension control switch pillar. There is also a similar motor having an output of 300 B.H.P. at a full load speed of 262 R.P.M. This motor is connected by flexible coupling to another ventilating fan, and is complete with rotor starter and high-tension control switch pillar.

Whitburn Colliery.—One three-phase induction motor, with bedplate and two pedestal bearings, complete with brush lifting and short-circuiting device, giving an output of 350 B.H.P. at a full-load speed of 106 R.P.M. on 5,500 volts three-phase 40 cycles, and connected by flexible coupling to a colliery ventilating fan; this motor is complete with liquid starter and high-tension control switch pillar. There are also five haulage motors of the ventilated type, the ventilating openings and slip-rings being protected against splashing and dripping of water, and the insulation specially impregnated to render it waterproof.

Each of these motors has two end shield bearings, and drives a main and tail haulage rope by means of gearing. This haulage is used for removing the trucks from the working face to the main galleries, where they are taken on by another haulage set. This side track is about ½ mile long, and mostly on a gradual incline upwards away from the working face. Each motor is capable of giving 60 B.H.P. for 1½ hours at a synchronous speed of 480 R.P.M. on 2,750 volts three-phase 40 cycles. Each motor is complete with an oil-immersed reversing controller with 12 steps each way, and a high-tension switchbox containing automatic oil switch, &c., is also provided.

For driving centrifugal pumps two motors of the same type as the above-mentioned haulage motors have been supplied, but they are fitted with brush lifting and short-circuiting device, and have a continuous output of 35 B.H.P. at a synchronous speed of 800 R.P.M. on 2,750 volts, three-phase, 49 cycles. Each of these pump motors is provided with suitable oil-cooled rotor starter and high-tension switch-box containing oil switch, &c.

Boldon Colliery.—One ventilated enclosed three-phase induction motor with ventilating openings and slip-rings protected against splashing and dripping of water. The insulation is specially impregnated to render it waterproof. This motor drives a fan by belt, and has an output of 50 B.H.P. at a synchronous speed of 480 R.P.M. when running on 2,750 volts three-phase, 40 cycles. It is controlled by an oil-cooled rotor starter and high-tension switchbox.

Barker & Allen's Rolling Mill.

The power for this rolling mill is obtained from the Birmingham Corporation's 5,000-volt mains, and is transformed down in a small sub-station in Messrs. Barker & Allen's works to 440 volts by two 220-KW. transformers. A low-tension switchboard is provided in the sub-station for distributing the 440-volt three-phase current to the various motors.

Messrs. Siemens Bros. Dynamo Works, Ltd., have supplied a 215 B.H.P. three-phase motor running at 300 R.P.M. for driving a rolling mill through ropes, and also a 120-B.H.P. motor for driving in a similar fashion. Both motors have three bearings and an extended bed-plate, and are controlled by amply-dimensioned liquid starters, permitting the motors to start up under the most severe conditions. A 50-H.P. three-phase motor, running at 375 R.P.M., is employed for driving a similar mill through gearing.

The following motors have been supplied for driving the various machinery in the wire mill, &c.:—One 22½-H.P. motor, running at 750 R.P.M.; three 15-H.P. motors, running at 750 R.P.M.; three 10-H.P. motors, running at 750 R.P.M.; three 7½-H.P. motors, running at 750 R.P.M.; two 2½-H.P. motors, running at 750 R.P.M. Each motor is provided with suitable starters and switchbox.

This plant has now been running for about a year with every satisfaction, and the order for the equipment of Messrs. Barker and Allen's new mill has recently been secured.

For some large glass works Messrs. Siemens Bros.' Dynamo Works, Ltd., have supplied three generators for an output of 660 KW. each, and three for outputs of 550, 525 and 330 KW. respectively; also five motors for 450 B.H.P. each, six for 180 B.H.P. each, and one for an output of 100 B.H.P.

For the British Aluminium Co. they have supplied a five-panel main distribution switchboard, capable of dealing with 2,000 amperes, and also 16 225-275-volt motors, ranging in output from 100 H.P. downwards.

A 130-KW. 260-volt 500 R.P.M. generator, with three bearings and pulley has been installed in a flour mill for supplying current for lighting.

The Dance of the Lamp-Makers. — To-morrow, Saturday, January 9th, Robertson's Social and Athletic Club will hold their third annual plain and fancy dress dance at the Brook Green Works, Hammersmith. Dancing from 7 to 12.

ELECTRIC GENERATION BY WIND POWER.

An interesting account of a wind-power station under his charge is given in the *E.T.Z.* by Herr J. Bohm. It is a private house plant situated near Hamburg, and supplies some 400 incandescent lamps, five motors ranging from 12 H.P. to 2 H.P. (22 H.P. total), as well as electric heating and cooking apparatus. The total connected power is about 40 KW., and previously two benzine engines of 12 and 20 H.P., driving direct-current dynamos giving 65 and 100 amperes at 110 volts, were used, together with a 60-cell battery of 495 ampere-hour capacity on a three-hour discharge at 165 amperes. With an

FIG. 1.—WIND TURBINE FOR PRIVATE HOUSE LIGHTING.

average daily load of 10 amperes in the summer and 20 amperes in the winter this old plant consumed 10,000 kg. of benzine, costing £105.

In October, 1907, a wind turbine (fig. 1) made by the Deutsche Windturbinen Werke, Dresden, was installed to do the bulk of the load, with a benzine set as a stand-by.

The wind turbine had a wheel of 12 m. diameter with fixed sheet steel arms of a suitable spiral form. This was erected on a steel tower 29 m. high—this unusual height being necessary in order to clear the surrounding trees. The power is transmitted to the

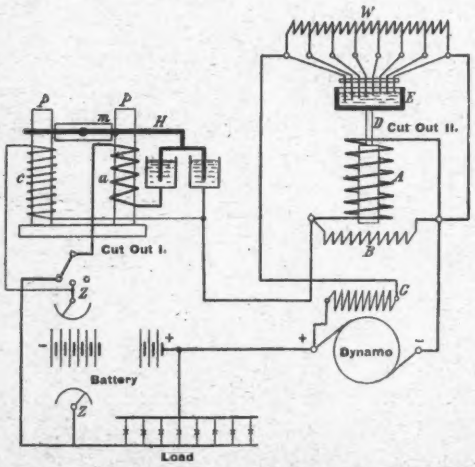


FIG. 2.—CONNECTIONS OF AUTOMATIC CUT-OUTS, &C.

dynamo through bevel gear and a vertical shaft. Two regulating vanes are provided—one for variations in the direction of the wind and the other for variations in the strength of the wind. The latter sets the plane of the wheel more nearly parallel to the wind direction as the strength of the wind increases.

The whole construction is exceptionally strong, and has withstood heavy storms in spite of its exposed position. Generation commences with a light wind of 3 or 4 metres per second, and in this district such a wind can be counted on during 10 hours a day on the average. The wheel is rated at 6 H.P. with a 4 to 5-metre wind, 14 H.P. with a 6 to 7-metre wind, and 20 H.P. with an 8-metre wind, the speed increasing correspondingly. Actually it was found to develop about 30 H.P. with an 8-metre wind. The dynamo is fitted with commutating poles and is designed for 80 amperes at 110 volts and 1,350 R.P.M., which corresponds to a wind of about 6-7 metres per second.

Two automatic cut-outs are employed, one of which cuts the dynamo in or out according as its pressure is above or below the battery pressure, and the other avoids excessive overloading of the dynamo when the wind increases suddenly, by inserting more or less resistance into the shunt automatically. The connections are shown in fig. 2. The first cut-out, to the left, consists of a two-limbed electromagnet having a shunt coil on one side and a series coil in the dynamo main circuit on the other side. This electro-magnet acts on a permanent magnet *m*, which carries the mercury cut-out contacts H. As long as the dynamo pressure is below the battery pressure, the shunt coil keeps the dynamo disconnected. When the dynamo pressure becomes equal to the battery pressure, no current flows in the shunt coil *c*, and any further rise in dynamo pressure reverses the current in *c*, and an excess of 5 volts causes the contacts to close. Then all current in *c* ceases, but the cut-out is kept closed by the dynamo current flowing in the series coil *a*. When the dynamo current falls to zero the cut-out opens again. It will be seen that it is the *difference* in voltage between dynamo and battery which operates the cut-out, so that the actual battery voltage at the time does not influence the working.

The second cut-out, to the right, has merely a series solenoid in the dynamo circuit, and the plunger carries a mercury trough, which short-circuits the contact pieces of graduated lengths in turn, and so alters the resistance in the dynamo shunt-circuit. The resistance B is for adjustment.

The operation of the plant has proved eminently satisfactory. It has been possible to dispense with aid from the benzine set for as long a period as 90 days on end, with an average daily load of 20 amperes.

The battery works under exceptionally good conditions, as the charging is slow with discharge intervals in between. The following particulars of cost are given:—

Capital Cost—	
Wind motor, tower and dynamo	£680
Battery	300
Benzine set as stand-by	600
Switchboard, cut-outs, instruments	55
Total	£1,635
Annual Charges—	
Interest	£82 0
Sinking fund	85 0
Repairs	20 0
Cleaning material and oil	5 0
Benzine (2,100 kg.)	22 10
Attendance for both wind and benzine motors ...	12 10
Total	£227 0

With the previous plant, consisting of two benzine sets and a battery, the capital cost was £1,030, and the annual charges as follows:—

Interest	£51
Sinking fund	82
Repairs	10
Cleaning material and oil	15
Benzine	105
Attendance	75
Total	£338

It is pointed out that the difference is chiefly due to the fact that the benzine sets require skilled attendance, which can be dispensed with when these sets are only used as a stand-by. The wind motor itself requires very little attention beyond the weekly filling of the lubricators.

An Electric Steel Plant.—The firm of Ochler & Co., Aaran, Switzerland, has recently installed in its works a Girod furnace for the manufacture of steel for machinery parts. It is designed with a capacity of 2 tons, and requires 400 H.P. This is the fourth similar furnace at work in Europe. Power is supplied to this firm at the cost of 9d. per KW.-day, which is transformed down to a single-phase current with a pressure varying between 65 and 75 volts, and a frequency of 37·4 per second. Twelve heavy copper cables carry the current to the furnace 10 metres away. The furnace has an internal diameter of 2 metres, is ½ metre high, and is electrically tipped and regulated. The electrode is automatically regulated to keep the current at the desired strength. The electrode is 350 mm. square, and 1,500 mm. long, and it lasts, as a rule, for 5 to 7 charges. The charging operation takes 1 hour, and 5 hours more are required to heat before pouring. The charge weighs 1,500 kg., the current is 5,500 amperes, and the voltage 55. Two heats a day are run, but three can be managed. A typical charge consists of a mixture of pig-iron, turnings, scrap and lime, to which is added a little ferro-manganese, ferro-silicon and aluminium. The finished product contains 0·5 per cent. carbon, 0·47 per cent. silicon, 0·27 per cent. manganese, a small quantity of sulphur, and a trace of phosphorus. Ninety-eight per cent. of the castings are good, with a tensile strength of 80,000 to 90,000 lb. per sq. in. The electrical efficiency is from 75 to 80 per cent., and the calorific efficiency 50 per cent.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BERMUDA.—The following are exempt from duty:—Electric cable, and electric cable machinery and apparatus, imported under contract with His Majesty's Government with the view of establishing and maintaining telegraphic communication with places beyond the sea; vessels, machinery and materials, imported for surveying or improving any of the channels or harbours of Bermuda under any contract or agreement with the Government.

All other electrical and similar goods ... ... 10% ad valorem

N.B.—No person may install, erect, construct, establish or maintain any instrument, apparatus or other thing for the purpose of transmitting or receiving messages by means of wireless telegraphy, without a licence from the governor.

The value of goods for payment of ad valorem duty is the true cost of the goods at the place whence they were imported, excluding cost of package and other charges.

BOLIVIA.—The import duties are levied in percentage of values fixed by the Customs; in cases where values have not been so fixed, duty is levied on the value of the goods as found by appraisement. In order to arrive at this appraisement, the consular invoice is taken as a basis, and its amount increased by 20 per cent. for freight and other charges from the market of origin, provided these expenses have not already been included in the invoice.

Consular invoices give particulars of value, gross and net weights, the name of the shipper, the port of shipment, the name of the Custom House to which consigned, the name of the consignee, &c. These invoices must be made out in quadruplicate in Spanish, on forms obtainable at the Bolivian Consulate, at a cost of 3s. per set of four. General descriptions of goods are not allowed, and the total value of the invoice is to be written below the total, in words at length. These invoices must be certified by the Bolivian Consul at the port of shipment, a fee of 2 per cent. of the value of the invoice being charged. If no Bolivian Consul exists at the port of shipment no signature will be required, but the fees will nevertheless be payable at the Custom House of entry into Bolivia. Goods not accompanied by a consular invoice will be charged double fees.

It is imperative that the exact net and gross weight in kg. be marked on each package and specified on invoices, bills of lading, &c. Net weight in kg. of each class of goods should be stated, and the origin of the goods should be declared on all documents.

Duties are levied at the gold rate of exchange of the boliviano. 12·50 bolivianos = £1 sterling. kg. = 2·204 lb.

Rate of duty shown in parentheses.	Value on which levied.
	Bols. per kg.
Steel in bars or plates	free
Insulators for telegraph or telephone	free
Oilers for machinery of all kinds (25%)	·40
Galvanised iron, bronze or copper wire (25%) ...	·40
Bronze or copper wire (25%)	·80
Wire for transmission of electric currents	free
Iron tinned, galvanised or not, for telegraphs ...	free
Tar, ordinary or pitch (30%)	·05
Electric apparatus for illumination and other purposes and its accessories, and utensils for telegraphs and telephones (10%)	...according to appraisement
Electric bells (25%)	...according to appraisement
Cast-iron conduits (15%)	·40
Earthenware tubing (30%)	·05
Lead or composition tubing (15%)	·20
Cement (15%)	·05
Asbestos cement (30%)...	·15
Belting for machinery, all kinds	free
Machines for industries, arts and sciences, whether imported in loose pieces or not	free
Motors for machines or engines	free
Paper in ribbons for telegraphs, unglazed	free
Electric batteries (10%)	...according to appraisement
White porcelain of all kinds, plain (30%)	·30
Porcelain decorated (30%)	·60
„ with brass, &c., ornaments (30%)... ...	1·20
	Bols. each.
Telephones (10%)	30
Valves of all kinds for machinery	free
	Bols. per kg.
Glassware:—	
White or coloured, with or without common figuring or gilding, of ordinary hollow glass (30%)	·24
Ditto, with metal edgings (30%)	·48
Medium or fine, with or without common figuring or gilding (30%)	·48
Ditto, with edging of common metal (30%) ...	1·40
Ditto, with edging of plaqué (30%)	1·60
Lamps or chandeliers, with or without chimneys, globes, shades and reflectors:—	
Of bronze, copper or brass, for hanging with counterweights (30%)	·50
Ditto, without counterweights (30%)	·70
Hanging lamps, of iron or steel, with counterweights (30%)	·40
	Bols. per kg.
Ditto, without counterweights (30%)	·60
With deposit of common metal, or cut or plain glass, with stand of bronze or copper, hand or table (30%)...	·60
Ditto, with stand of iron, zinc, earthenware, &c. (30%)	·40
Entirely of glass, hand or table (30%)	·20
Small hand lamps for mines	free
Lamp-shades of paper, cotton or pasteboard (30%)	3
Of silk, with or without admixture (35%) ...	according to appraisement
Of glass, porcelain or earthenware, dutiable as glass, porcelain or earthenware goods.	
	Bols. per doz.
Buttons for electric bells (30%)	6
Candelabra and candlesticks equipped for electric lighting (25%)	according to appraisement
Iron:—	
Sheet, chanelled or plain, neither painted, tinned nor galvanised	free
	Bols. per kg.
Ditto, painted, tinned or galvanised (25%) ...	·15
Manufactured into articles not mentioned, whether painted, tinned, &c., or not (25%)	·50
Ditto, nickel plated (25%)	1·00
Ditto, with facing of earthenware or porcelain (25%)	·90
Manufactured into elbows, crosses, unspecified chains, buoys, rails, wheels, and parts of machinery for mines, arts and industries ...	free
Railway cars	free

Roechling-Rodenhauser Furnace for Three-Phase Currents.—In a recent issue of *Stahl und Eisen* the following interesting development of the above induction furnace is described by Neumann. The chief novel feature is that the furnace is operated by three-phase currents. Already more than 1,000 tons of steel rails have been made for the German railroads in this new furnace. One of the chief disadvantages of all single-phase induction furnaces is that special generators are required, producing a current of low frequency. In the new type, now described, this problem has been completely solved. A new 1·5-ton Roechling-Rodenhauser furnace is operated with currents of a frequency of 50 periods and is directly connected to the ordinary three-phase supply network of the works. Three-phase current furnaces are now built for charges up to 3 tons, while with a frequency of 25 it is possible to increase the charge up to 8 or 10 tons. The hearth of a 1·5-ton furnace is ½ metre wide and 1½ metres long. The three transformer cores are surrounded by heating channels. Where two such channels meet the main hearth, pole plates are provided. Each of the three transformer cores is provided with a primary winding. Above each primary is a secondary winding, one end of which is connected to a bus-bar, and the other ends to the pole plates. A peculiar feature of this type of furnace is the rotation of the charge, due to the presence of a rotary field as in an induction motor. In this manner an excellent automatic circulation is provided. These furnaces produce steel superior to that of the open hearth process, especially with respect to its greater density and homogeneity. The energy consumption for a liquid charge is from 200 to 300 KW.-hours. The voltage and current curves are almost straight lines, which shows that sudden variations in the load need not be considered. The power factor is from 0·75 to 0·80.

Steel Transmission Belts.—The *Electrotechnischer Anzeiger* quotes figures from which it appears that steel bands are less than a quarter as expensive for use as transmission belts, as compared with leather belts. The following figures express in shillings the initial and annual costs, and it is maintained that the transmission of 100 H.P. with a distance of 10 metres between centres at 200 R.P.M. and a diameter of the pulleys of 1 metre costs only 0·07 shilling per hour. The annual costs are as follows; the first figures represent steel bands, the second belts, &c., and the third ropes:—

	Shillings.	Shillings.	Shillings.
(*a*) Capital cost of belts, &c.	250	400	740
„ „ driving apparatus ...	750	1,300	600
(*b*) Loss of energy	0·5%	6%	13%
Annual loss, 1,500, 1,800, 39,000 H.P.-hrs. or	105	1,260	2,730
(*c*) Annual cost, 5 % interest	50	85	67
10 % depreciation of belts, &c. ...	25	40	74
20 % depreciation of driving gear ...	150	260	120
Loss of energy	105	1,260	2,730
Total annual cost	330	1,260	2,730

In this comparison, leather, rubber and cotton belts are classed together, and no distinction is made between hemp and wire rope. In favour of steel bands, it is argued that they do not stretch or slip, and that there is less wear and tear; being stronger, less width is required. In comparison with other transmission gear, they are more efficient; their efficiency is estimated at 99 per cent. Experiments have shown that a steel band 10 mm wide and 0·5 mm. in thickness can be used for the transmission of 146 H.P., running perfectly noiselessly. The bands being so light, they may be used for very high speeds, even up to 80 metres per second.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford price, post free, 9d. (in stamps).

1907.

Method of and Means for Controlling Electric Appliances in Connection with Electric Circuits. R. F. Venner and R. C. Griesbach. 25,716. November 20th.

Electrically-Controlled Locks and Latches. T. O. Summers, O. J. Wootton, T. Hill and W. H. Green, trading as the Reliable Lock and Brass Foundry Co. 27,611. December 14th.

Electrical Switches. H W. Cox. 27,792. December 17th.

Electro-Deposition of Iron. S. O. Cowper-Coles. 12,747. June 1st. (Post-dated December 2nd, 1907.)

Electric Switches. British Thomson-Houston Co. and E. B. Wedmore. 20,774. September 18th.

Globe or Shade Holder for Inverted Incandescent and other Gas Lights and for Electric Lights. H. G. Richardson. 21,928. October 4th. (Post-dated April 6th, 1908.)

Electro-Deposition. L. Hausmann. 25,669. November 20th. (Date applied for under International Convention, November 23rd, 1906.)

Distribution of Electricity. W. J Davy. 25,878. November 22nd.

Combined Telephone Receivers and Transmitters. G. Anzalone. 25,968. November 23rd.

Lifting Magnets. A. C. Eastwood. 26,143. November 26th.

Machines for Coating Wires and the like, Particularly Adapted for Insulating Electric Conductors. British Thomson-Houston Co. (General Electric Co., United States.) 28,487. December 27th.

Electrically-Controlled Railway Block Signalling and Apparatus therefor. P. Browne. 10,660. May 6th. (Post-dated May 4th, 1908.)

Contacts for Electric Controllers or Switches. A. White. 19,708. September 3rd.

Commutating Devices for Electrical Machines. E. Windrath. 26,048. November 25th.

Electric Chain-Welding Machines. M. B. Ryan. 26,354. November 28th.

Method of Extinguishing Electric Arc Lamps. Beck Flame Lamp, Ltd. (Deutsche Beck Bogenlampen Ges., Germany.) 26,410. November 29th.

Commutating Dynamo-Electric Machines. V. A. Fynn. 25,911. December 5th.

Arc Lamps. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges., Germany.) 27,182. December 7th.

Induction Apparatus. W. H. Nix, J. A. Harper and E. L. Lane. 27,164. December 9th.

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Electric Railway and Tramway Systems. R. C. Thomson. (D. Kempt, Argentine Republic.) 1,187. January 18th.

Means or Apparatus for Heating by Electricity. L. A. Frank. 1,696. January 24th. (Cognate Application 6,981/08.)

Luminous Electric Heaters. W. F. Howard and A. B. Cousins. 2,927. February 10th.

Means for Indicating or Detecting the Existence of High Voltage to which a Body may be Electrically Raised. W. M. Thornton, H. W. Clothier and A. Reyrolle & Co. 3,369. February 14th.

Controllers for Electric Motors. H. Lyon. 4,193. February 25th.

Electrically-Controlled Railway Points and Signals. Siemens Bros. & Co. and L. de M. G. Ferreira. 4,694. March 4th.

Electric Arc Lamps. Johnson & Phillips, Ltd., and S. Paterson. 5,029. March 5th.

Cooling the Commutator of a Dynamo-Electric Machine. Siemens Bros. and Co. and C. M. Toplis. 6,101. April 11th. (Application for Patent of Addition to No. 7,255/06.)

Turbo-Electric Generator Systems. E. J. Berg. 8,622. April 16th. (Date applied for under International Convention, April 20th, 1907.)

Electric Order and Alarm Apparatus. J. J. F. Dickmann. 8,558. April 16th.

Devices for Protecting Transformers, Cables and other Electrical Apparatus. Allgemeine Elektricitäts Ges. 9,237. April 28th. (Date applied for under International Convention, April 29th, 1907.)

Electric Switches. J. Miles. 9,509. May 1st.

Electric Signalling Systems for Railways and the like. A. J. Boult. (Union Switch and Signal Co., United States.) 9,850. May 6th.

Storage Battery Plates. A. O. Tate. 10,764. May 18th. (Date applied for under Rule 13, December 20th, 1907.)

Storage Battery Plates. A. O. Tate. 10,767. May 18th. (Date applied for under Rule 13, December 20th, 1907.)

Storage Battery Plates. A. O. Tate. 10,768. May 18th. (Date applied for under Rule 13, December 20th, 1907.)

Starting Switches for Electric Motors. D. Timar and K. von Dreger. 11,064. May 21st. (Date applied for under International Convention, June 5th, 1907.)

Fittings for Incandescence Electric Lamps. A. G. Bloxam. (Siemens Schuckertwerke Ges.) 13,661. June 27th.

Telephonic Systems. E. A. Graham. 14,425. July 7th.

Magneto Machines for Use in Connection with the Ignition Systems of Internal-Combustion Engines. R. F. Hall. 15,289. July 20th.

Electrically-Sounded Horns. A. H. Nicholson. 15,461. July 21st.

Magneto-Electric Igniting Device with Asymmetric Polar Pieces. T. Bergmann. 17,809. August 25th.

Terminal for Magneto-Electric Ignition Apparatus. Firm of R. Bosch. 20,288. September 26th. (Date applied for under International Convention, November 15th, 1907.)

Magneto-Electric Machines. H. W. van Raden. 112. January 2nd.

Alternating-Current Electric Motors of the Induction Type. Crompton and Co., J. C. Macfarlane and H. Burge. 892. January 14th.

Electrical Means for Regulating Temperature in a Number of Places. H. G. Geissinger. 1,304. January 20th.

Gravity Switches as Applied to Telephones and the like. J. E. Kingsbury (Bell Telephone Manufacturing Co., Belgium.) 1,950. January 28th.

Electrical Motor. L. P. J. A. H. Messier. 2,222. January 31st.

Manufacture of Electrical Resistances. C. Ruzicka. 4,657. March 2nd.

Mercury or other Vapour Electric Lamps. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 5,596. March 2nd.

Fittings for Electric Glow Lamps. Siemens Schuckertwerke Ges. 9,636. May 4th. (Date applied for under International Convention, June 25th, 1907.)

Manufacture of Electrical Resistances. C. Ruzicka. 9,762. May 5th.

Manufacture of Electrical Resistances. C. Ruzicka. 9,763. May 5th.

Safety Fuses for Switchboards. E. Peters. 9,832. May 6th.

Variable-Speed Gear for Electric Automobiles. C. M. de Sainte-Clare. 9,876. May 6th. (Date applied for under International Convention, November 7th, 1907.)

Arc Lamp. F. Ruzicka. 10,269. May 12th.

Manufacture of a Plastic Mass from Tungsten Compounds. Siemens and Halske Akt.-Ges. 11,710. May 29th. (Date applied for under International Convention, August 3rd, 1907.) (Application for Patent of Addition to No. 16,489/07.)

Telephone Cordless Switchboards. W. Aitken. 15,819. July 25th.

Telephone Apparatus. C. F. Bradburn. 17,905. August 15th. (Date applied for under Rule 13, February 25th, 1908.)

Ventilating the Rotors of Dynamo-Electric Machines. Siemens Bros. Dynamo Works and E. O. Kieffer. 17,414. August 19th.

Arc Lamp. Regina Bogenlampenfabrik Ges. and P. Hanisch. 17,509. August 20th.

Surface Contact System of Electric Traction. S.P. (Suchostawer Patents) Syndicate and H. M. Sayers. 18,216. August 31st.

Devices for Protecting Transformers, Cables, and other Electrical Apparatus. Allgemeine Elektricitäts Ges. 21,608. October 12th. (Date applied for under International Convention, April 29th, 1907.) (Originally included in No. 9,237/08.)

Electromagnetically-Operated Regulating or Switching Apparatus. O. Rennert. 155. January 2nd.

Electric Cycle Lamps. M. H. Goldstone, J. H. Ward and A. Goldstone. 1,019. January 16th.

Vehicles Propelled by a Combination of Electrical and Mechanical Power. W. N. Stewart, E. B. Killen and F. Harris. 1,751. January 25th.

Electrically-Operated Ammunition Hoisting Apparatus. P. M. Justice. (Otis Elevator Co. (Incorporated.) 2,985. February 10th.

Electrical Alarm Locks. L. E. L. Themke. 4,482. February 28th.

Means for Electrically Igniting Gas Burners or Lamps. A. J. Hill and F. C. D. Mann. 4,560. February 28th.

Electric Cables. H. Gray. 5,199. March 2nd.

Incandescing or Heating Bodies Containing or Consisting of Zirconium for Incandescent Electric Lamps, Heaters and the like. British Thomson-Houston Co. (General Electric Co., United States.) 5,415. March 10th.

Methods of Generating Electrical Oscillations. W. H. Eccles and A. J. Makower. 6,644. March 25th.

Alternating-Current Motors of the Commutator Type. British Thomson-Houston Co. (General Electric Co., United States.) 6,960. March 28th.

Electric Furnaces. H. Nathusius and Westdeutsche Thomasphosphatwerke Ges. 7,923. April 9th. (Application for Patent of Addition to No. 7,188 of 1908.)

Ampere-Hour Meters. W. Meyerling. 8,018. April 10th. (Date applied for under International Convention, August 7th, 1907.)

Means for Reducing the Reflex Action at the Points of Connection of Electrical Conductors or Circuits Differing in the Values of their Electrical Properties. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 10,171. May 11th. (Application for Patent of Addition to No. 9,273/1906.)

Insulating Supports for High-Tension Conductors. R. D. Mershon. 10,317. May 12th. (Date applied for under International Convention, May 21st, 1907.)

Clamping Device for Electric Contacts or Brushes. S. Paterson and M. J. Dark. 10,632. May 15th.

Electric Railway System for Collecting and Delivering Mail. W. H. Mozingo. 12,411. June 9th. (Date applied for under International Convention, June 10th, 1907.)

Apparatus for Wireless Telegraphy. J. Sahulka. 12,468. June 10th.

Safety Spark Gap Devices for Use in Connection with the Ignition Systems of Internal-Combustion Engines. R. F. Hall. 16,849. August 11th. (Date applied for under Rule 13, July 20th, 1908.)

Electric Switches. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 17,410. August 19th.

Commutators for Electrical Machinery. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges., Germany.) 17,417. August 19th.

Apparatus to Disinfect the Telephone Speaking Tube. J. W. Mackenzie. (Telephon Disinfectoren Ges., Germany.) 17,772. August 24th.

Keyboard Telegraphic Transmitters. S. E. Page. (Telegraph Transmitting Instrument Co., United States.) 17,841. August 25th.

Electric Traction on the Surface Contact System. S.P. (Suchostawer Patents) Syndicate, Ltd., and H. M. Sayers. 18,713. September 7th.

Interrupter for Electric Ignition Apparatus of Explosion Motors. C. Ebner. 19,388. September 15th.

Electro-Pneumatic Device Intended to Indicate Attempts to Tamper with Articles to be Protected. E. Seragnoli. 20,179. September 25th.

Apparatus for Use as Resistances in Electric Circuits. M. Hankin and F Wolff. 20,352. September 28th.

Peat as Central Station Fuel.—Some time ago reference was made in this journal to a scheme for the utilisation of peat as fuel in connection with a generating station to be erected on the Aurich Wiesmoor, East Friesland. The station, which is reported to be nearly finished, is intended not only for the supply of light and power within a radius of 31 miles, but also to deliver power for the driving of ploughs or excavators on the moors in connection with a network of canals which is in contemplation. It appears that the excavated peat is electrically transported to two electrically-operated presses near Macards moor, and after being dried the peat blocks are used as fuel in gas generators. The gasification of the peat is effected according to a new system which has already been tested at the Mont Cenis colliery, near Herne, and sulphate of ammonia is recovered as a by-product of the process. It is stated that a chemical analysis of samples of peat from the Wiesmoor has shown that one ton of bulk peat will yield 66 lb. of sulphate of ammonia and 2,500 cb. ft. of power gas on the basis of the system adopted in this locality. The station has been equipped by the Hanseatic Siemens-Schuckert Works, of Hamburg, and the Augsburg-Nuremberg Machine Works Co., the former having secured a concession to work the station for a period of 75 years.

Marylebone Electricity Department Sick Club.—We have before us a copy of the second annual balance sheet of this Club for the year 1908. The total income was £127 (£107 of this was members' subscriptions). Sick pay was given to 27 members, and this together with working expenses absorbed £47, leaving a surplus of £80. In December last there was a share out to 71 members at 22s. 6d. each.